

REVISION OF THE NEOTROPICAL FAMILY INBIOMYIIDAE (DIPTERA, SCHIZOPHORA)

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ABSTRACT. The Central and South American family Inbiomyiidae with its single genus *Inbiomyia* Buck is revised, including descriptions of 10 new species: *I. acmophallus* Buck sp. nov. (Colombia), *I. anemosyris* Buck sp. nov. (Colombia, Peru), *I. matamata* Buck sp. nov. (Venezuela, Colombia), *I. pterygion* Buck sp. nov. (Bolivia), *I. regina* Buck sp. nov. (French Guiana), *I. exul* Buck sp. nov. (Costa Rica, Ecuador), *I. empheres* Buck sp. nov. (Ecuador), *I. anodonta* Buck sp. nov. (Colombia), *I. scoliostylus* Buck sp. nov. (Costa Rica), and *I. zeugodonta* Buck sp. nov. (Colombia, French Guiana). Three species known from single females are briefly diagnosed but not named. A key to the 11 described species of *Inbiomyia* is provided. The species-level phylogenetic relationships are analyzed on the basis of a matrix of 35 morphological characters. Four species groups are recognized: the *I. anemosyris* group (*I. acmophallus*, *I. regina*, *I. pterygion*, *I. matamata*, *I. anemosyris*), the *I. exul* group (*I. exul*, *Inbiomyia* species 1), the *I. mcalpineorum* group (*I. empheres*, *I. mcalpineorum*, *Inbiomyia* species 2), and the *I. scoliostylus* group (*I. anodonta*, *I. scoliostylus*, *I. zeugodonta*, *Inbiomyia* species 3).

INTRODUCTION

The family Inbiomyiidae, recently erected for the newly described Neotropical acalyptrate genus *Inbiomyia* Buck, 2006, is the fourth family of Cyclorrhapha to be described on the basis of a newly discovered group of flies in the past 50 years (i.e., excluding families erected through taxonomic "splitting"). None of the other 3 families, Xenasteiidae Hardy, 1980, Neminidae D.K. McAlpine, 1983 (originally as a subfamily of Aulacigastridae), and Marginidae D.K. McAlpine, 1991, occur in the New World. Inbiomyiidae is in fact the only valid family of Cyclorrhapha that has ever been described from the New World on the basis of a newly discovered genus. Other relatively recently erected families were based on genera described decades earlier, the most recent examples being Teratomyzidae Colless and D.K. McAlpine, 1970 (based on *Teratomyza* Malloch, 1933), and Syringogastridae do Prado, 1969 (based on *Syringogaster* Cresson, 1912).

Inbiomyiidae are characterized by several highly unusual and unique morphological features of the head, male and female genitalia, and egg. Buck (2006) placed Inbiomyiidae as the sister group of the monotypic Australasian family Australimyziidae, within the superfamily Carnoidea. The larval biology of *Inbiomyia* remains unknown, but the unusual egg morphology suggests a specialized biology. So far, species of Inbiomyiidae have been found in 8 Central and South American countries from Guatemala in the north to Bolivia and French Guiana in the south. The actual range probably includes the entire

tropical part of the Neotropical region with the apparent exception of the Caribbean. Inbiomyiidae occur in primary tropical forests (rain and cloud forest) from sea level to 2000 m, with the highest number of species found at low elevations.

The morphology, biology, family relationships, and history of discovery of Inbiomyiidae were discussed in detail by Buck (2006). The family was described with the single included species *Inbiomyia mcalpineorum* Buck, 2006; we here add another 10 new species to the family and consider the distribution and phylogeny of the species.

MATERIALS AND METHODS

MORPHOLOGY AND TERMINOLOGY

The morphological terminology largely follows J.F. McAlpine (1981a). Postabdominal features were examined on specimens cleared in hot 10% KOH and subsequently neutralized in glacial acetic acid. Eggs were obtained by dissection from cleared abdomens of gravid females (museum specimens). Dissected parts are kept in glycerine in a microvial with the specimen.

PHOTOGRAPHY

The habitus photograph (Fig. 1) was taken with a Microptics Digital Lab XLT imaging system using a Canon EOS 1 Ds camera and Microptics ML-1000 flash fiber optic illumination system. Each image was assembled from a series of photographs (with different focal planes) using the computer freeware CombineZ (Hadley, 2005). Wing and egg photographs (Figs. 9, 10, 13) were taken with a Nikon Coolpix 4500 digital camera mounted on a Zeiss compound microscope.

PHYLOGENETIC ANALYSIS

Parsimony analysis of the character matrix was performed with PAUP* 4.0b10 for Windows (Swofford,

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Figure 1 *Inbiomyia exul* Buck sp. nov., female (Corcovado National Park, Puntarenas Province, Costa Rica). Scale 0.2 mm

2001) using the “branch and bound” algorithm. Branch support was calculated with PAUP* according to Bremer (1994). The Bremer value for a certain branch indicates the minimum number of additional steps (compared to the most parsimonious tree[s]) that is required to generate a tree (or trees) in which the branch in question is unresolved. High Bremer values therefore indicate strong branch support.

ABBREVIATIONS

Costal ratios: e.g., Cs2/Cs3 = length of costal sector 2/length of costal sector 3. Costal sector 2 is measured between the apices of R_1 and R_{2+3} , Cs3 between apices of R_{2+3} and R_{4+5} , and Cs4 between apices of R_{4+5} and M (Fig. 10).

ABBREVIATIONS OF DEPOSITORIES

AMNH American Museum of Natural History, New York, New York, U.S.A.

CBFC Colección Boliviana de Fauna, La Paz, Bolivia
 CNCI Canadian National Collection of Insects, Ottawa, Ontario, Canada
 DEBU Department of Environmental Biology, University of Guelph, Guelph, Ontario, Canada
 INBC Instituto Nacional de Biodiversidad (INBio), Santo Domingo de Heredia, Costa Rica
 LACM Natural History Museum of Los Angeles County, Los Angeles, California, U.S.A.
 UNCB Museo de Historia Natural, Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Sante Fé de Bogotá, Colombia

SYSTEMATICS

Family Inbiomyiidae

Inbiomyiidae Buck, 2006: 379 (type and only included genus: *Inbiomyia* Buck, 2006).
 Genus *Inbiomyia* Buck.

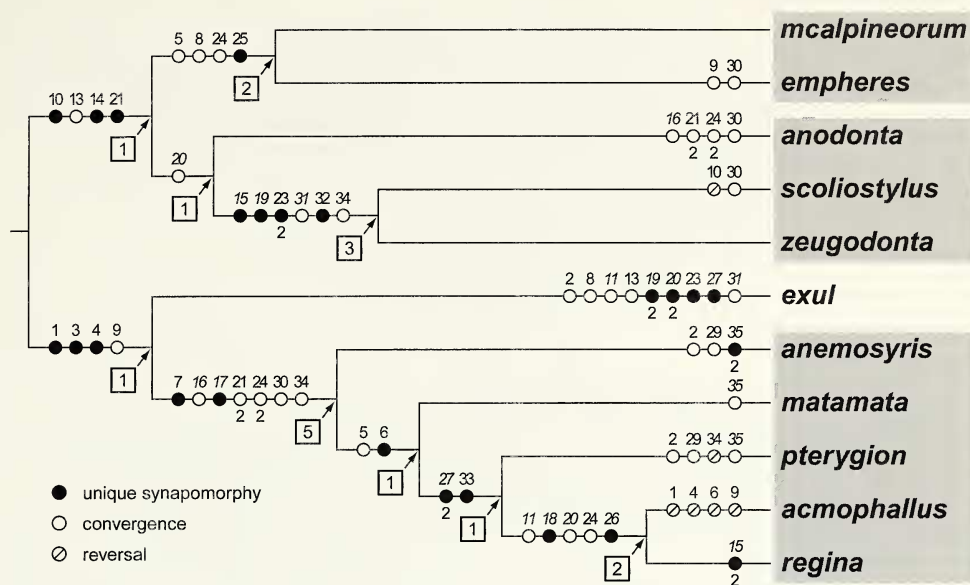


Figure 2 Species-level phylogeny of *Inbiomyia*. Explanations: Character numbers are given above the circles; states for multistate characters below the circles. Characters whose polarity was established by the FIG-FOG method (see text) are italicized on the tree. Bremer support values are shown in rectangles beside each node

Inbiomyia Buck, 2006: 379 (type species: *I. mcalpineorum* Buck, 2006, by original designation).

DESCRIPTION. A detailed description was provided elsewhere (Buck, 2006). The most important morphological features are summarized below.

Small, mostly dark, acalyptrate flies (Fig. 1); body length 1.3–1.6 mm.

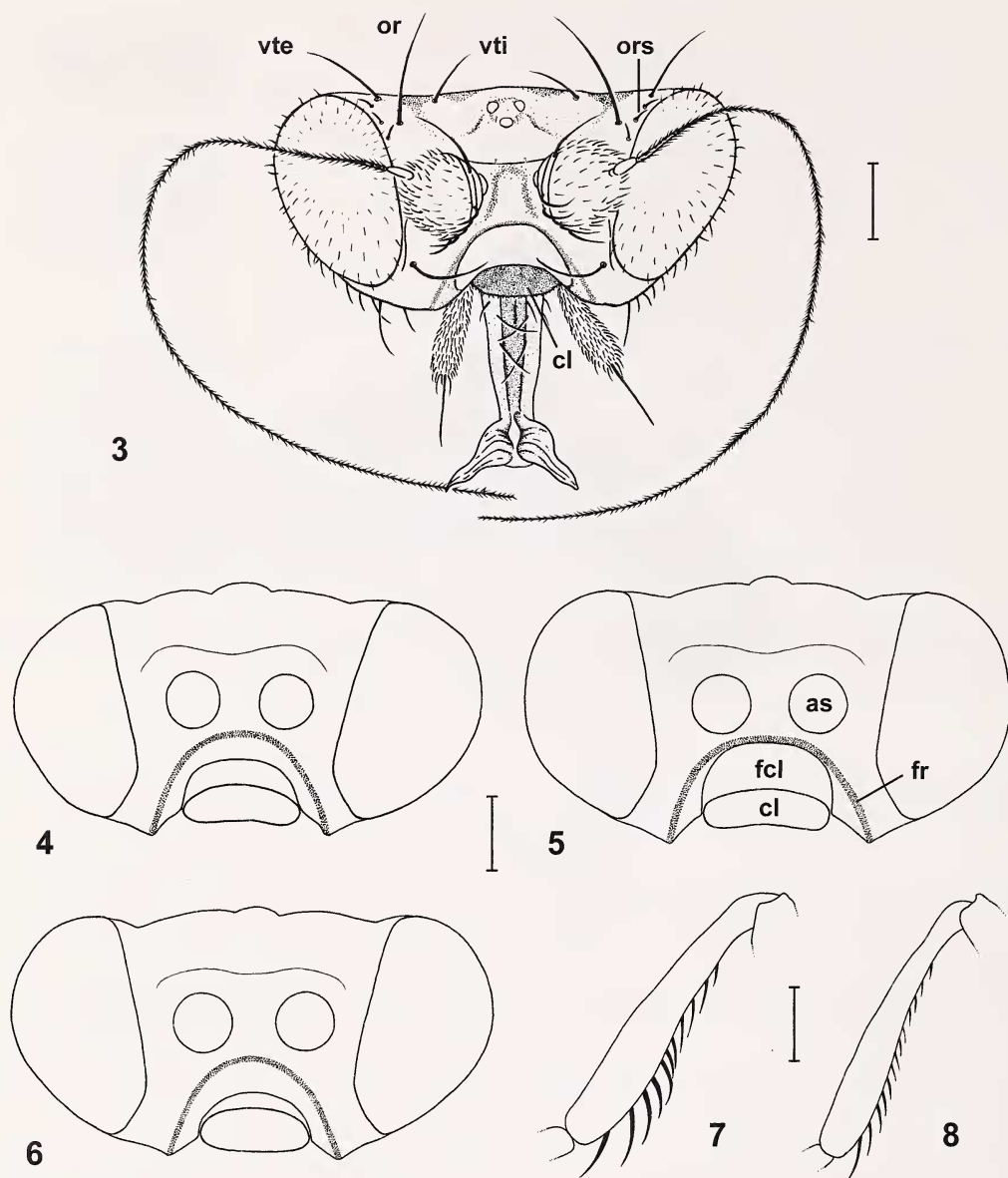
Head (Fig. 3). Very short, wider than thorax, with protuberant eyes. Head chaetotaxy reduced, including single long, inclinate orbital bristle, inner and outer vertical bristles, long vibrissa, shorter subvibrissal and several genal bristles, and strong ventral preapical bristle on palpus. Ocellar plate very large and shining, occupying most of frons. Ptilinum extremely reduced. Face with arcuate, ridgelike internal thickening at or above lower margin, here called “lower facial ridge” (Fig. 5: fr); lower margin deeply emarginate. Eye short-pubescent. Antenna short with small scape and pedicel, and hemispherical first flagellomere bearing extremely long, pubescent, dorsoapical arista. Proboscis with small, largely separate labella pointing in nearly opposite directions.

Thorax. Strongly arched, humpbacked with the following complement of bristles: 3 dorsocentrals (one presutural), 2 supra-alar (pre- and postsutural), postalar, small postpronotal (sometimes hairlike), 2 notopleurals (posterior one inserted much higher than anterior one), (1–)2 scutellars (anterior one usually hairlike, sometimes absent), and dorsoproclinate katapisternal. Acrostichal

setulae in 2, often short rows. Pleuron without hairs or bristles except on katapisternum. Legs slender. Forefemur with anteroventral, posteroventral and posterodorsal series of bristles, femora otherwise devoid of bristles. Male foretibia slightly clavate in some species (Fig. 7), usually with row of enlarged, more or less erect ventral bristles on apical half (Fig. 6), tibiae otherwise devoid of bristles (including ventroapical bristle of mid tibia). Wing (Figs. 9, 10) with incomplete subcosta and very short R_1 ; costa with humeral and subcostal breaks, reaching M (weaker in last sector), with small, well-spaced spinules on second and base of third sector. Cell cup with convex outer margin; anal vein very strong, fading away before wing margin. Halter with darkened knob.

Preabdomen. With 4 large tergites (syntergite 1+2, tergites 3 and 4, male syntergite 5+6 or female tergite 5).

Male Terminalia. Sternites 5, 6, and 7 fused, separate from short, transverse sternite 8 (Buck, 2006: figs. 4A–C). A small ring-shaped sclerite (nonfunctional remnant of left spiracle 7?) present dorsally between syntergite 5+6 and synsternite 5+6+7. Epandrium saddle-shaped, anteroventrally with a pair of slender processes on each side (Fig. 15: vp) which are either fused to or articulated with the epandrium, posteroventrally with a pair of lobes (fused cerci?) behind each surstylus (Fig. 16: vl). Perianal field (Fig. 16: pf) usually closed ventrally by subanal plate (divided medially by suture). Surstylus (Fig. 15: ss) usually with slender basal and dilated distal portion,

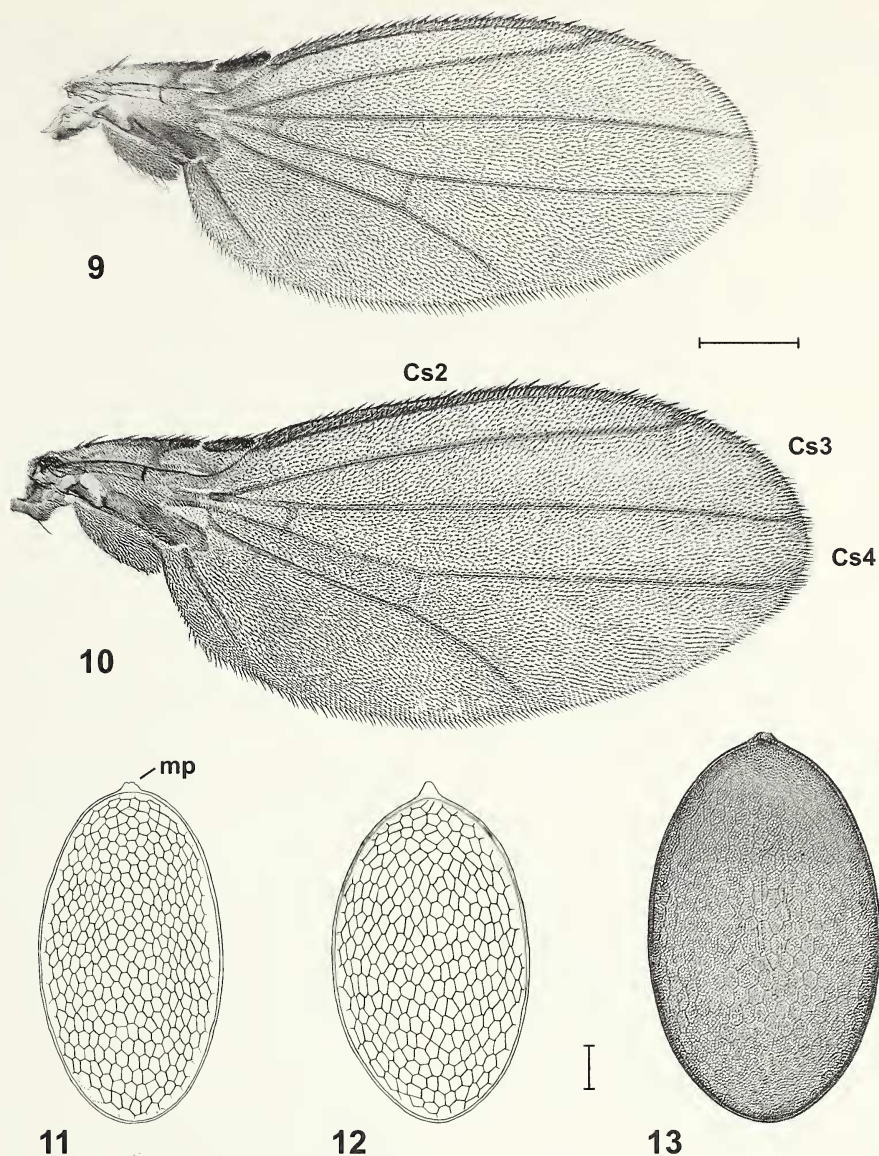


Figures 3–8 *Inbiomyia* heads and male foretibiae. 3. *I. mcalpineorum* Buck, head, frontal (slightly modified from fig. 3A in Buck, 2006). 4. *I. matamata* Buck sp. nov., head capsule, frontal. 5. *I. acmophallus* Buck sp. nov., ditto. 6. *I. exul* Buck sp. nov., ditto. 7. *I. regina* Buck sp. nov., left male foretibia. 8. *I. anemosyris* Buck sp. nov., ditto. Scale 0.1 mm. Abbreviations: as—antennal socket, cl—clypeus, fcl—frontoclypeal membrane, fr—lower facial ridge, or—orbital bristle, ors—orbital setulae, vte—outer vertical bristle, vti—inner vertical bristle. Drawings: A. Cormier (3) and M. Musial (4–8)

usually bearing conspicuous bristles. Hypandrium Y-shaped with slender anterior apodeme (Fig. 15: ha). Postgonites (Fig. 16: pg) well developed (absent in 1 species), with stout bristles. Phallapodeme rodlike, separate from hypandrium (Fig. 16: pa). Phallus clearly divided into basiphallus and distiphallus (Fig. 20: bp, dp). Basiphallus sclerotized, with simple, anchor- or shieldlike epiphallus. Distiphallus short and simple, completely membranous; surface in part striate, in

part nonstriate with small spicules and/or microtrichia. Ejaculatory apodeme small and inconspicuous, disklike (Fig. 21).

Female Terminalia. Ovipositor broadly truncate, nonteleoscopic; tergite 7 narrowed or divided medially, sternite 7 comparatively broad and long, laterally almost reaching corresponding tergite (narrowly fused to tergite in some species); all sclerites beyond segment 8 completely reduced, cerci absent. Intersegmental membrane behind



Figures 9–13 *Inbiomyia* wings and eggs. 9. *I. exul* Buck sp. nov., right wing. 10. *I. anemosyris* Buck sp. nov., ditto. 11. *I. acmophallus* Buck sp. nov., egg, dorsal (first published in Buck, 2006: fig. 5C). 12. *I. zeugodonta* Buck sp. nov., ditto. 13. *I. exul* Buck sp. nov., ditto. (photograph of cleared and slide-mounted specimen). Scale 0.2 mm (wings), 0.05 mm (eggs). Abbreviations: Cs—costal sector, mp—micropyle. Drawings: A. Cormier (11, 12)

sternite 7 pouchlike, with a field of conspicuous, posteriorly directed (when invaginated), serrate or crenulate scalelike cuticular outgrowths. Sternite 8 hardly discernable, completely membranous and medially divided. Two moderately sclerotized, tire-shaped, oval, or egg-shaped spermathecae with striate surface. Spermathecal ducts short, joining genital chamber separately; duct insertion lateral to main axis of spermatheca.

Egg (Figs. 11–13). Mature eggs were obtained from 5 species (*I. acmophallus* sp. nov., *I. pterygion* sp. nov., *I. regina* sp. nov., *I. exul* sp. nov., *I. zeugodonta* sp. nov.) and are very uniform

across the genus. Size large compared to abdomen, shape elliptical (length 0.39–0.48 mm, width 0.21–0.27 mm, length/width ratio 1.67–1.86), strongly flattened dorsoventrally (thickness estimated at *ca.* 0.05 mm). Ventral surface membranous, unornamented; dorsal surface thicker, coarsely granulose and unpigmented, with polygonal, reticulated pattern. Micropyle on small elevation.

DIAGNOSIS. *Inbiomyia* (Inbiomyiidae) can be identified using the key to Neotropical Diptera families by Buck *et al.* (in press). The following characters are diagnostic: small, acalyptrate flies

Table 1 Character state matrix for described species of *Inbiomyia*. Australimyziidae, the sister group of Inbiomyiidae, served as outgroup for the analysis. Putative ground-plan character states of Inbiomyiidae ("ancestor") were in part determined after the analysis using the FIG-FOG method (see text).

Species	Character numbers																			
	1					2					3									
	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890
Australimyziidae	0000000000	??00??????	0?000???00	?	0000?	0000000000	0?00000000	0?00000?00	?	00000	0000000000	0?00000?00	?	00000	00000	0000000000	0?00000?00	?	00000	00000
(ancestor)	0000000000	0?00000000	0?00000?00	?	00000	0000000000	0?00000000	0?00000?00	?	00000	0000000000	0?00000?00	?	00000	00000	0000000000	0?00000?00	?	00000	00000
<i>I. anemosyris</i>	1111001010	0000011000	2002000011	0	00012	1111111010	0000011000	2002000001	0	00011	1111111010	0000011000	2002000001	0	00011	1111111010	0000011000	2002000011	0	00101
<i>I. matamata</i>	1011111010	0000011000	2002000001	0	00011	1111111010	0000011000	2002000001	0	00011	1111111010	0000011000	2002000001	0	00011	1111111010	0000011000	2002000011	0	00101
<i>I. pterygion</i>	1111111010	0000011000	2002000001	0	00011	1111111010	0000011000	2002000001	0	00011	1111111010	0000011000	2002000001	0	00011	1111111010	0000011000	2002000011	0	00101
<i>I. acmophallus</i>	0010101000	1000011101	2001012001	0	00110	1010101000	1000011101	2001012001	0	00110	1010101000	1000011101	2001012001	0	00110	1010101000	1000011101	2001012001	0	00110
<i>I. regina</i>	1011111010	1000211101	2001012001	0	00110	1011111010	1000211101	2001012001	0	00110	1011111010	1000211101	2001012001	0	00110	1011111010	1000211101	2001012001	0	00110
<i>I. exul</i>	1111000110	1010000022	0110001100	1	10000	1111000110	1010000022	0110001100	1	10000	1111000110	1010000022	0110001100	1	10000	1111000110	1010000022	0110001100	1	10000
<i>I. mcalpineorum</i>	0000100101	0111000000	1001100000	0	00000	0000100101	0111000000	1001100000	0	00000	0000100101	0111000000	1001100000	0	00000	0000100101	0111000000	1001100000	0	00000
<i>I. empheres</i>	0000100111	0111000000	1001100001	0	00000	0000100111	0111000000	1001100001	0	00000	0000100111	0111000000	1001100001	0	00000	0000100111	0111000000	1001100001	0	00000
<i>I. anodonta</i>	00?0000001	0111010001	2102000001	0	0????	00?0000001	0111010001	2102000001	0	0????	00?0000001	0111010001	2102000001	0	0????	00?0000001	0111010001	2102000001	0	0????
<i>I. scoliostylus</i>	0000000000	0111100011	1120000101	1	11010	0000000000	0111100011	1120000101	1	11010	0000000000	0111100011	1120000101	1	11010	0000000000	0111100011	1120000101	1	11010
<i>I. zeugodonta</i>	0000000001	0111100011	1120000100	1	11010	0000000001	0111100011	1120000100	1	11010	0000000001	0111100011	1120000100	1	11010	0000000001	0111100011	1120000100	1	11010

with (1) very shortened head (frons) and protruding eyes, (2) single pair of inclinate orbital bristles, (3) well-developed vibrissae, (4) no ocellar or postvertical bristles, (5) extremely long and nearly apically inserted arista, (6) strongly divergent and largely free labella, (7) aset(ul)ose anepisternum, (8) complete wing venation except for reduced subcosta, and (9) costa with humeral and subcostal breaks. In previously published keys, *Inbiomyia* runs to Aulacigastridae (e.g., J.F. McAlpine, 1981b) or does not key out properly (e.g., Hennig, 1973: conflict at couplet 138).

BIOLOGY. There are no direct observations on the biology of *Inbiomyia*. Adults are apparently microbial grazers as can be concluded from the substantial amounts of fungal, algal (including diatoms), and probably bacterial material found in the guts of dissected specimens. Nearly 80% of the currently known material of *Inbiomyia* (ca. 220 specimens in total) was collected in Malaise traps, another 16% in pan traps placed in decaying vegetation (mostly decaying foliage of fallen trees). The junior author observed an adult of an unidentified species on green leaves of a recently fallen tree at Rara Avis (Heredia, Costa Rica). The presence of adults on decaying plant matter suggests a phytosaprophagous larval biology (larvae feeding on the microbial flora of the substrate). However, the comparatively large egg size and low number of mature eggs per female (1–4 in dissected specimens) is unusual for species developing in a nutrient-rich, rapidly decaying, ephemeral food source. Most Diptera that exploit this type of substrates are r-strategists and produce large numbers of relatively small eggs. The unusual egg morphology, which is reminiscent of macrotype Tachinidae eggs, could be indicative of a more specialized, possibly parasitic, lifestyle.

SPECIES-LEVEL PHYLOGENY OF INBIOMYIA

Characters Used in Phylogenetic Analysis

Characters were polarized based on the putative outgroup Australimyziidae (Buck, 2006). No additional outgroups were taken into consideration because the sister group of Inbiomyiidae + Australimyziidae is uncertain (Carnidae are the putative sister group of Inbiomyiidae + Australimyziidae, but support for this relationship is weak; see Buck, 2006). Inbiomyiidae and Australimyziidae have diverged considerably, especially in male and female postabdominal features. Fourteen of the 35 characters (Table 1), mostly male genitalic characters, could therefore not be polarized through outgroup comparison. Eleven of these characters could be polarized *a posteriori* (i.e., after the parsimony analysis; see "ancestor" in Table 1) using the "functional ingroup–functional outgroup" ("FIG-FOG") approach (Watrous and Wheeler, 1981). The polarity of 3 characters (12, 22, 28) remains ambiguous.

In the following list of characters, apomorphic states are coded with "1" or "2" and plesiomorphic states with "0" (except characters 12, 22, 28). Character 21 is ordered. Polarities of characters denoted by asterisks (*) were established *a posteriori*.

Head, Thorax, and Legs

- 1
- Facial sclerotization below lower facial ridge: 0—largely absent (Fig. 5); 1—present (Fig. 6)
- 2
- Ocellar hairs: 0—present; 1—absent
- 3
- Inner vertical bristle, length: 0—more than half as long as orbital bristle; 1—at most half as long as orbital bristle

- 4 Dorsocentral hairs between postsutural and prescutellar dorsocentral bristles: 0—present; 1—absent
- 5 Male foretibia, row of ventral bristles: 0—absent or weakly developed (Fig. 8); 1—strongly developed (Fig. 7)
- 6 Male foretibia shape: 0—simple (Fig. 8); 1—slightly clavate (Fig. 7)

Male Terminalia

- 7 Syntergite 5+6, ventral lobe below spiracle 6: 0—absent; 1—present (Fig. 17: tl)
- 8 Ventral portion of synsternite 5+6+7 (= sternite 5), posterior process of right side: 0—absent (Fig. 17); 1—present (Fig. 54: prv)
- 9 Lateral portion of synsternite 5+6+7 (= sternite 6), posterior process: 0—absent (Fig. 17); 1—present (Fig. 27: prl)
- 10 Epandrium, dorsolateral anterior apodemes: 0—absent (Fig. 15); 1—present (Fig. 62: ap)
- 11* Perianal field: 0—elliptical (Fig. 41); 1—not elliptical (Fig. 16)
- 12 Subanal plate: 0—desclerotized or weakly sclerotized; 1—strongly sclerotized (polarity unknown)
- 13 Articulation of epandrium/hypandrium: 0—broad; 1—narrow (Buck, 2006: fig. 4E)
- 14 Ventral process of epandrium: 0—fused to epandrium (Fig. 15); 1—articulated with epandrium (Fig. 62)
- 15* Ventral process of epandrium, apex: 0—slender (Fig. 18); 1—broadly truncate (Fig. 87); 2—bilobate (Fig. 49)
- 16* Ventral process of epandrium, shape: 0—curved medially (Fig. 18); 1—not curved medially (Fig. 66)
- 17* Ventral process of epandrium, small point at or near apex: 0—absent (Fig. 66); 1—present (Fig. 18)
- 18* Ventral process of epandrium, stout blunt bristles on inner surface: 0—absent (Fig. 28); 1—present (Fig. 18)
- 19* Posteroventral lobe of epandrium: 0—large (Fig. 16: vl); 1—small (Fig. 76); 2—absent (Fig. 57)
- 20* Surstylus basal portion: 0—more or less parallel-sided (Fig. 25); 1—widening distally (Fig. 15); 2—tapering distally (Fig. 56)
- 21 Surstylus apical portion: 0—not expanded (Fig. 56); 1—slightly to moderately expanded (Fig. 62); 2—greatly expanded (Fig. 15)
- 22 Surstylus apical portion, discal bristles: 0—none or 1 (Fig. 15); 1—several (Fig. 68) (polarity unknown)
- 23 Surstylus apical portion, peglike bristle(s): 0—absent (Fig. 15); 1—1 (Fig. 57); 2—2 (Fig. 85)
- 24 Surstylus apical portion, marginal row of hairs: 0—absent (Fig. 75); 1—irregular (Fig. 47); 2—regular (Fig. 25)

- 25 Postgonite, stout, peglike bristles of apical row: 0—less than 8 (Fig. 14); 1—more than 8 (Fig. 61)
- 26* Postgonite, stout apical bristle and slender preapical hair: 0—small or absent (Fig. 24); 1—enlarged (Fig. 14)
- 27* Epiphallus shape: 0—slender (Fig. 29); 1—broad throughout (Fig. 60); 2—apically expanded (Fig. 19)
- 28 Epiphallus, dorsal surface: 0—smooth; 1—striate (Fig. 57) (polarity unknown)
- 29 Distiphallus shape: 0—simple (Fig. 20); 1—twisted (Fig. 44)
- 30 Distiphallus vestiture: 0—microtrichose (Fig. 60); 1—bare
- 31* Distiphallus surface: 0—spinulose (Fig. 29); 1—smooth

Female Terminalia

- 32 Female tergite 7: 0—entire; 1—medially divided (Fig. 81)
- 33 Female sternite 7, pigmentation: 0—evenly pigmented; 1—partially pale
- 34 Female tergite 8, anterior apodeme: 0—absent (Fig. 80); 1—present (Fig. 81)
- 35* Spermatheca: 0—tire-shaped (Fig. 22); 1—oval (Figs. 37, 38); 2—egg-shaped (Fig. 23)

RESULTS OF PHYLOGENETIC ANALYSIS

The analysis yielded a single most parsimonious tree (Fig. 2; tree length 71, consistency index = 0.61, retention index = 0.72, rescaled consistency index = 0.44). Four species groups are recognized: the *I. anemosyrus* group (*I. acmophallus*, *I. regina*, *I. pterygion*, *I. matamata*, *I. anemosyrus*), the *I. mcalpineorum* group (*I. empheres*, *I. mcalpineorum*), the *I. exul* group (*I. exul*), and the *I. scoliosstylus* group (*I. anodonta*, *I. scoliosstylus*, *I. zeugodonta*). The latter 3 groups each include 1 unnamed species (see species accounts below), which were not included in the analysis because they are known from females only. Most species groups are well defined and show moderate to high Bremer support. The exception is the *I. scoliosstylus* group, which is well supported only if *I. anodonta* is excluded. The latter shares only 1 synapomorphy with the remainder of the species (character 20, state 1), which occurs convergently in *I. acmophallus* + *I. regina*.

Biogeography

The *I. anemosyrus* group is the only species group of *Inbiomyia* restricted to South America. All other groups are represented in both Central and South America. Because of the still fragmentary knowledge on *Inbiomyia* (many species still to be discovered, poorly known species distributions), it

is difficult to develop meaningful hypotheses on the phylogeography of the group. Interestingly, all Central American species have their sister species in South America (*I. exul*, occurring in both South and Central America, and its Central American sister species, *Inbiomyia* sp. 1, represent a special case). On the basis of current phylogeny, it appears most likely that the stem species of *Inbiomyia* lived in South America, and its descendants colonized Central America on at least 3 different occasions.

KEY TO THE SPECIES OF INBIOMYIA BUCK
(Note: Three unnamed species are known from females only and are not included in the key.)

- 1 Entire katepisternum (and sometimes also ventral margin of anepisternum) white, yellow or brownish yellow, contrasting with medium to dark brown anepisternum (e.g., Fig. 1) 2
- At least dorsal portion of katepisternum medium to dark brown and hardly paler than anepisternum 5
- 2 Upper pleuron (anepisternum, anepimeron, postnotum) uniformly dark brown, sharply contrasting with white to whitish yellow lower pleuron throughout its whole length (Fig. 1). $Cs2/Cs3 \leq 2.0$, $Cs3/Cs4 > 2.5$ (Fig. 9). Surstylus angulate, not expanded apically (Fig. 56). Hypandrium with long, forked ventral process (Fig. 53). Female tergite 7 entire (Fig. 52). Spermatheca tire-shaped (Fig. 52) (Costa Rica, Ecuador) *I. exul* Buck sp. nov.
- Upper pleuron not uniformly colored; at least anepimeron paler than anepisternum, the former not sharply contrasting with yellow lower pleuron. $Cs2/Cs3 \geq 2.8$, $Cs3/Cs4 \leq 2.3$ (e.g., Fig. 10). Surstylus either greatly expanded apically or not angulate. Hypandrium without forked ventral process. Either female tergite 7 divided or spermatheca asymmetrically egg-shaped 3
- 3 Inner vertical bristle ca. 0.75× as long as orbital bristle. Anterior scutellar bristle 0.3–0.4× as long as posterior one, distinctly longer and more robust than acrostichal hairs. 1–3 dorsocentral setulae between postsutural and prescutellar dorsocentral bristles. Apex of surstylus slightly expanded, without fringe of long bristles (Fig. 84). Female tergite 7 narrowly divided medially; spermatheca tire-shaped (Fig. 82) (Colombia, French Guiana) *I. zeugodonta* Buck sp. nov.
- Inner vertical bristle at most half as long as orbital bristle. Anterior scutellar bristle small and hairlike, subequal to acrostichal hairs. No setulae between postsutural and prescutellar dorsocentral bristles. Apex of surstylus greatly expanded, with fringe of long bristles

- (Fig. 25). Female tergite 7 entire; spermatheca asymmetrically egg-shaped (Fig. 23) 4
- 4 Ocellar plate glossy, without any trace of microtomentum. Male foretibia slightly clavate, with distinctly enlarged, nearly erect ventral bristles (Fig. 7). Slender basal portion of surstylus not extending beyond apex of posteroventral epandrial lobe (Fig. 46). Ventral epandrial process with distinctly bilobate apex; median lobe with several stout apical bristles (Fig. 49). Female sternite 7 partially desclerotized and pale, especially sublaterally (French Guiana) . . . *I. regina* Buck sp. nov.
- Ocellar plate shining but with thin microtomentum. Male foretibia simple, with only slightly enlarged, inclined ventral bristles (Fig. 8). Slender basal portion of surstylus extending far beyond apex of posteroventral epandrial lobe. Ventral epandrial process not bilobate, with minute, bare median projection (Fig. 25). Female sternite 7 evenly sclerotized and brown (Colombia, Peru) *I. anemosyris* Buck sp. nov.
- 5 $Cs2/Cs3 < 2.5$. Surstylus with greatly expanded apical portion bearing discal as well as marginal bristles (Figs. 68, 69); marginal bristles few in number and spaced widely. Female unknown. [Face not sclerotized below lower facial ridge. Ventral epandrial process articulated to epandrium.] (Colombia) *I. anodonta* Buck sp. nov.
- $Cs2/Cs3 \geq 3.0$. Surstylus with moderately or greatly expanded apical portion, if greatly expanded then with marginal bristles only (e.g., Fig. 15); marginal bristles, if present, more close-set 6
- 6 Inner vertical bristle almost as long as orbital bristle. Anterior pair of scutellar bristles longer than acrostichals, ca. one-third as long as posterior scutellars. Ventral epandrial process biangulate in lateral view; surstylus lacking fringe of long bristles, with 2 stout, peglike bristles apically (Fig. 75). Female tergite 8 with long anterior apodeme (Fig. 81: ap); tergite 7 broadly divided medially (Fig. 81) (Costa Rica) . . *I. scolistylus* Buck sp. nov.
- Inner vertical bristle $< 0.7\times$ as long as orbital bristle (Fig. 3). Anterior pair of scutellar bristles short, hairlike and subequal to acrostichals, or absent. Ventral epandrial process straight in lateral view. Surstylus with fringe of 6–16 long bristles, lacking stout peglike bristles. Female tergite 8 without or with very short anterior apodeme, tergite 7 entire or medially divided 7
- 7 Male perianal area elliptical, sharply delimited ventrally by dark brown, sclerotized subanal plate (e.g., Fig. 63). Surstylus only moderately expanded apically, and with fringe of few long bristles (e.g., Fig. 62). Female tergite 8 without anterior apodeme. Ca. 2 dorsocentral setulae

- between postsutural and prescutellar dorso-central bristles 8
- Male perianal area not elliptical, either poorly delimited ventrally from weakly sclerotized subanal plate (e.g., Fig. 32) or its margins parallel to slightly divergent ventrally (Fig. 16). Surstylus broadly expanded distally, with fringe of numerous long bristles (e.g., Fig. 15). Either female tergite 8 with short anterior apodeme (Fig. 22) or scutum without setulae between prescutellar and postsutural dorsocentral bristles 9
- 8 Subanal plate and hind margin of epandrium almost forming a right angle in lateral view; ventral epandrial process with straight posterior margin; postgonite directed anteriorly (Buck, 2006: fig. 6B). Female tergite 7 medially very narrow but not interrupted, laterally fused to sternite (Buck, 2006: fig. 7A) (Costa Rica) *I. mcalpineorum* Buck
- Angle formed by subanal plate and hind margin of epandrium obtuse (Fig. 62). Ventral epandrial process with a posterior tubercle at base of apical third (Fig. 65). Postgonite directed ventrally (Fig. 63). Female tergite 7 medially interrupted, laterally not fused to sternite (Fig. 80) (Ecuador) *I. empheres* Buck sp. nov.
- 9 Face not sclerotized below lower facial ridge (Fig. 5). Male perianal field angulate ventrolaterally (Fig. 16). Fringe of bristles of distal portion of surstylus extending far onto dorsal margin (Fig. 15). Ventral epandrial process with 2 long apical hairs and several stout, blunt-tipped bristles on medial surface (Fig. 18). Female sternite 7 pigmented darker laterally and medially. Spermatheca tire-shaped (Fig. 22) (Colombia) *I. acmophallus* Buck sp. nov.
- Facial sclerotization extending below level of lower facial ridge (Fig. 4). Perianal field elliptical. Fringe of bristles of distal portion of surstylus ending at or near posterior corner (e.g., Fig. 40). Ventral epandrial process without apical hairs, medially with slender fine-tipped bristles only (e.g., Fig. 43). Female sternite 7 often evenly pigmented, if not then darker medially but not laterally. Spermatheca oval (Figs. 37, 38) 10
- 10 Ocellar plate glossy and lacking microtomentum on each side of ocellar area. Forecoxa brown, at least basal half distinctly darker than remainder of leg. Expanded distal portion of surstylus with angulate anterior corner (Fig. 31). Epiphallus nearly parallel-sided (Fig. 35). Ventral epandrial process tapered, without long hairs in apical fourth (Fig. 34). Female sternite 7 evenly pigmented (Venezuela, Colombia) *I. matamata* Buck sp. nov.
- Ocellar plate shining but sparsely microtomentose throughout. Forecoxa yellow, con-

colorous with remainder of leg. Expanded distal portion of surstylus broadly rounded anteriorly (Fig. 40). Epiphallus greatly expanded apically, anchor-shaped (Fig. 44). Ventral epandrial process not tapered, with several long hairs on inner surface of apical fourth (Fig. 43). Female sternite 7 darker medially (Bolivia) *I. pterygion* Buck sp. nov.

SPECIES ACCOUNTS

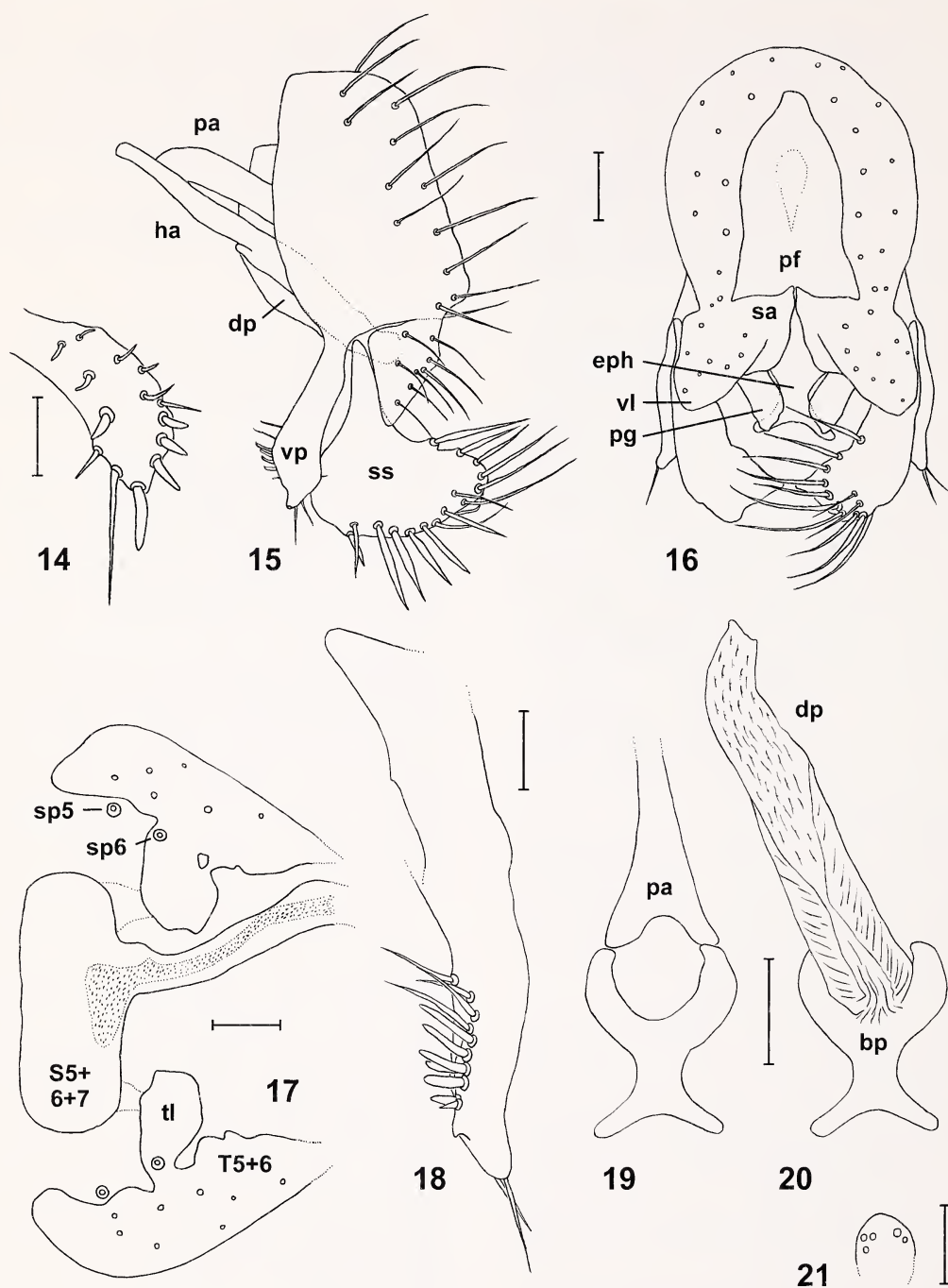
Inbiomyia anemosyris species group

SPECIES INCLUDED. *I. acmophallus* sp. nov., *I. anemosyris* sp. nov., *I. matamata* sp. nov., *I. pterygion* sp. nov., and *I. regina* sp. nov.

DIAGNOSIS. Inner vertical bristle at most half as long as orbital bristle. Facial sclerotization usually extending below lower facial ridge (Fig. 4; except in *I. acmophallus*). Usually without dorsocentral setulae between postsutural and prescutellar dorsocentral bristles (except in *I. acmophallus*). R_{2+3} not shortened, $Cs2/Cs3 \geq 3.0$. Male syntergite 5+6 with a pair of ventral lobes below spiracles 6 (Fig. 17: tl). Ventral epandrial process fused to epandrium, not curved medially, at or near apex with a small, usually medially directed toothlike process. Surstylus with greatly enlarged apical portion, bearing distinct row of long marginal bristles and no discal bristles. Hypandrium broadly connected to epandrium. Distiphallus spinulose, without microtrichia.

Inbiomyia acmophallus Buck sp. nov.
Figs. 5, 11, 14–22; Buck, 2006: fig. 5B

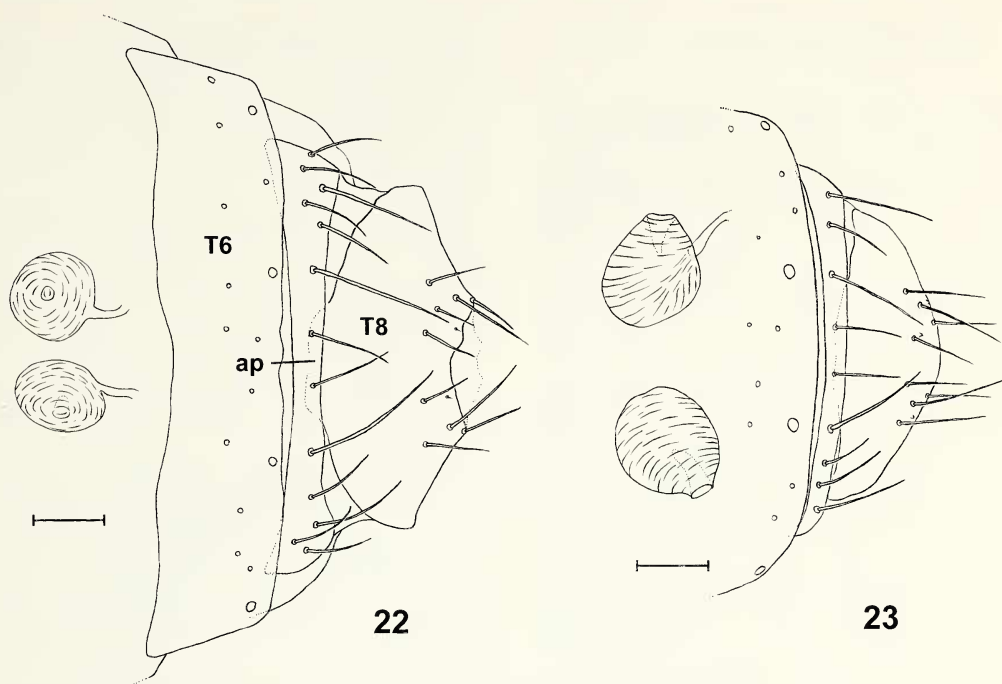
ADULT. Wing length 1.41–1.49 mm (♂), 1.44–1.56 mm (♀). Sclerotized portions of head dark brown excluding prementum, which is yellow to brownish yellow. Antenna dark brown, almost concolorous with frons; palpus slightly paler. Frons, besides usual long inclinate orbital bristle, with 2 orbital hairs and a pair of ocellar setulae. Ocellar plate sparsely microtomentose. Face not sclerotized below lower facial ridge (Fig. 5). Thorax including pleuron dark brown, katepisternum slightly and gradually becoming paler ventrally and anteriorly. 1–3 dorsocentral setulae between postsutural and prescutellar dorsocentral bristles; acrostichal rows of hairs extending posteriorly to at least level of postsutural dorsocentral bristle. Scutellum with posterior pair of bristles only, anterior pair absent. Legs including forecoxa brownish yellow. Both antero- and posteroventral rows of bristles of forefemur stronger and darker in male than in female; bristles of posteroventral row slightly stronger than anteroventral row in both sexes. Distal half of male foretibia with well-developed row of short, semierect, blackish, ventral bristles. Wing slightly infusate. $Cs2/Cs3 = 3.0\text{--}3.8$, $Cs3/Cs4 = 1.6\text{--}2.1$.



Figures 14–21 *Inbiomyia acmophallus* Buck sp. nov., male terminalia. 14. Left postgonite, anterior. 15. Hypopygium, left lateral. 16. Ditto, posterior (bristles of postgonites and left surstylus omitted). 17. Segments 5–8, ventral. 18. Left ventral epandrial process, anterior. 19. Phallapodeme and basiphallus, dorsal. 20. Phallus, ventral. 21. Ejaculatory apodeme, posterodorsal. Scale 0.05 (15–17, 19–20), 0.025 mm (14, 18, 21). Abbreviations: bp—basiphallus, dp—distiphallus, eph—epiphallus, ha—hypandrial apodeme, pa—phallapodeme, pf—perianal field, pg—postgonite, S—sternite, sa—subanal plate, sp—spiracle, ss—surstylus, T—tergite, tl—ventral lobe of syntergite 5+6, vl—posteroventral lobe of epandrium, vp—anteroventral process of epandrium. Drawings: A. Cormier

MALE TERMINALIA (Figs. 14–21). Synsternite 5+6+7 without posterior process on ventral or lateral portion (Fig. 17). Ring-shaped sclerite present but faint. Epandrium brown, without pair

of anterior apodemes dorsally, ventrally continuous with subanal plate, which is less sclerotized and paler than epandrium. Perianal field ventrally with parallel to slightly divergent lateral margins



Figures 22–23 *Inbiomyia* spp., female terminalia and spermathecae, dorsal. 22. *I. acmophallus* Buck sp. nov. 23. *I. anemosyris* Buck sp. nov. Scale 0.05 mm. Abbreviations: ap—anterior apodeme of tergite 8, T—tergite. Drawings: A. Cormier

(Fig. 16). Ventral epandrial process (Fig. 18) brownish yellow, more or less straight and apically narrowed, medially with a single to partially double row of bristles; these bristles becoming shorter, stouter, and blunter distally; a small medial tubercle near apex, one (almost) apical and one subapical bristle. Surstylus (Fig. 15) brownish yellow, marginal fringe of bristles arranged in 1 irregular row. Hypandrium broadly and firmly connected to anteroventral margin of epandrium by a tight suture, posteriorly with a relatively shallow emargination between the 2 arms (as in Buck, 2006: fig. 4E). Postgonite (Fig. 14) short and yellow, directed ventrally (Fig. 16), with 1 long, thin, subapical bristle and numerous shorter bristles, some of which are stout and blunt-tipped (including apical bristle). Epiphallus anvil-shaped, yellow (Fig. 19). Unlike other species, the epiphallus cannot swing out beyond (posterior to) the immobile postgonites. Distiphallus (Fig. 20) moderately long, distally with indistinct, short spicules and no microtrichia.

FEMALE TERMINALIA (Fig. 22). Tergite 7 entire, separate from sternite laterally. Sternite 7 unevenly pigmented, darker laterally and medially; extent of pale area highly variable, sometimes including entire midsection. Tergite 8 with short anterior apodeme (Fig. 22: ap), paler than preceding tergites (except its anterior margin); posterior margin slightly angled with shallow emargination between angles. Spermatheca weak-

ly sclerotized, pale brown, tire-shaped with small central invagination and laterally inserted duct.

EGG (Fig. 11). The most elongate egg of all examined species (length 0.39 mm, width 0.21 mm). Otherwise as in generic description.

TYPE MATERIAL. Holotype. ♂, UNCB, COLOMBIA: Comisaría Amazonas, Amacayacu National Park, Sector Matamata, 150 m, 27.iii–3.iv.2000, Malaise, A. Parente.

Paratypes. 15♂, 41♀, COLOMBIA: Same locality as holotype, 27.iii–3.iv.2000, A. Parente (1♂, 5♀, LACM; 2♂, 2♀, DEBU); 3–9.iv.2000, A. Felix (7♂, 20♀, UNCB; 1♂, 3♀, DEBU; 2♂, LACM); 11–24.iv.2000, A. Felix (1♂, 3♀, DEBU; 2♀, LACM); 24.iv–2.v.2000, A. Parente (1♀, LACM); Amacayacu National Park, San Martín, 150 m, 24.iii–3.iv.2000, Malaise, B. Amado (1♂, UNCB; 1♀, DEBU).

DIAGNOSIS. The male of this species is characterized by a peculiar, anvil-shaped epiphallus. It is distinguished from *I. pterygion*, the only other species with an apically expanded epiphallus, by the surstylus, which bears 1–2 bristles on the dorsal margin of the expanded apical portion (absent in *I. pterygion*) and has an irregular fringe of long bristles (regular in *I. pterygion*). The female can be diagnosed by the uniformly dark brown pleuron, entire tergite 7, and pale tergite 8.

ETYMOLOGY. The species name is used as a noun in apposition and refers to the anvil-shaped epiphallus (Gr. *akmon*: anvil).

Inbiomyia anemosyris Buck sp. nov.

Figs. 8, 10, 23–29

ADULT. Wing length 1.26–1.41 mm (♂), 1.34–1.44 mm (♀). Sclerotized portions of head dark brown excluding prementum, which is yellow to brownish yellow. Antenna dark brown, almost concolorous with frons; palpus slightly paler. Frontal orbit with 2–3 hairs in addition to strong bristle. Ocellar plate sparsely microtomentose, ocellar setulae absent. Facial sclerotization extending below level of lower facial ridge. Thorax distinctly bicolored. Lower pleuron yellow, proepisternum and anepisternum (excluding posteroventral corner) dark brown (concolorous with scutum); anterior two-thirds of anepimeron and posteroventral corner of anepisternum yellow to brownish yellow; posterior third of anepimeron, and postnotum medium brown; area around suture between anepimeron and katatergite somewhat darker. No dorsocentral setulae between postsutural and prescutellar dorsocentral bristles; acrostichal rows of hairs extending posteriorly slightly beyond level of transverse suture. Scutellum with a small anterior pair of hairs, subequal in size to acrostichal hairs. Legs including forecoxa brownish yellow. Antero- and posteroventral rows of bristles of forefemur slightly stronger and darker in male than in female; bristles of posteroventral row slightly stronger than anteroventral row in both sexes. Ventral row of short, semierect bristles in distal half of male foretibia weaker and not as dark as in some other species (Fig. 8). Wing membrane slightly infusate. $Cs2/Cs3 = 3.0\text{--}3.5$, $Cs3/Cs4 = 1.5\text{--}2.0$.

MALE TERMINALIA (Figs. 24–29). Synsternite 5+6+7 with a posterior process on its lateral portion (Fig. 27: prl). Ring-shaped sclerite present. Epandrium brown, posteroventral lobes paler; pair of anterodorsal apodemes not developed. Subanal plate continuous with epandrium but poorly sclerotized. Perianal field (Fig. 26) elliptical, ventral margin not clearly delimited from subanal plate. Ventral epandrial process (Fig. 28) brownish yellow (darker at base), in lateral view almost straight and with blunt apex, medially with a double row of bristles; bristles of inner row longer than those of outer row; bristles of both rows with fine tips; apex with a field of *sensilla trichodea* and a small, medially directed process but no bristles. Surstylus (Fig. 25) brownish yellow, marginal fringe of bristles arranged in a regular row; bristles of this row broadly spaced anteriorly. Hypandrium broadly connected to anteroventral margin of epandrium by a tight suture, posteriorly with a relatively small emargination between the 2 arms (as in Buck, 2006: fig. 4E). Postgonite (Fig. 24) short and yellow, directed ventrally (Fig. 26), with *ca.* 4 stout, blunt-tipped bristles near apex and several longer bristles with fine tips

in distal two-fifths. Epiphallus (Fig. 29) yellow, slender, parallel-sided with truncate tip, slightly curved posteriorly in lateral view. Distiphallus (Fig. 29) moderately long, twisted distally, and curved toward right side; its surface in distal half and ventromedially with indistinct short spicules and no microtrichia.

FEMALE TERMINALIA (Fig. 23). Tergite 7 entire, separate from sternite laterally. Sternite 7 evenly sclerotized. Tergite 8 with short anterior apodeme, dark brown and concolorous with preceding tergites; its posterior margin convex without medial emargination. Spermatheca weakly sclerotized, pale brown, asymmetrically egg-shaped with apical invagination and laterally inserted duct.

TYPE MATERIAL. Holotype. ♂, UNCB, COLOMBIA: Comisaría Amazonas, Amacayacu National Park, Sector Matamata, 150 m, 27.iii–3.iv.2000, Malaise, A. Parente.

Paratypes. 23♂, 10♀, COLOMBIA: Comisaría Amazonas, Amacayacu National Park, Sector Matamata, 150 m, 12–19.iii.2000, Malaise, A. Felix (2♂, LACM); same data except 20–26.iii.2000, A. Felix (1♀, UNCB); same data except 27.iii–3.iv.2000, A. Parente (6♂, 1♀, DEBU); same data except 3–9.iv.2000, A. Felix (9♂, 2♀, UNCB; 1♀, LACM); same data except 11–24.iv.2000, A. Felix (3♂, 1♀, LACM); Amacayacu National Park, San Martín, 150 m, 24.iii–3.iv.2000, Malaise, B. Amado (1♂, 1♀, UNCB; 1♂, DEBU); same data except 22–30.iv.2000 (1♀, DEBU). PERU: Departamento Loreto, Teniente López, 24.vii.1994, riverine forest, flight intercept trap, #199, R. Leschen (1♂, DEBU); same data except 26.vii.1993, #211 (1♀, DEBU); 1.5 km N Teniente López, 24.vii.1993, flight intercept trap, R. Leschen (1♀, DEBU).

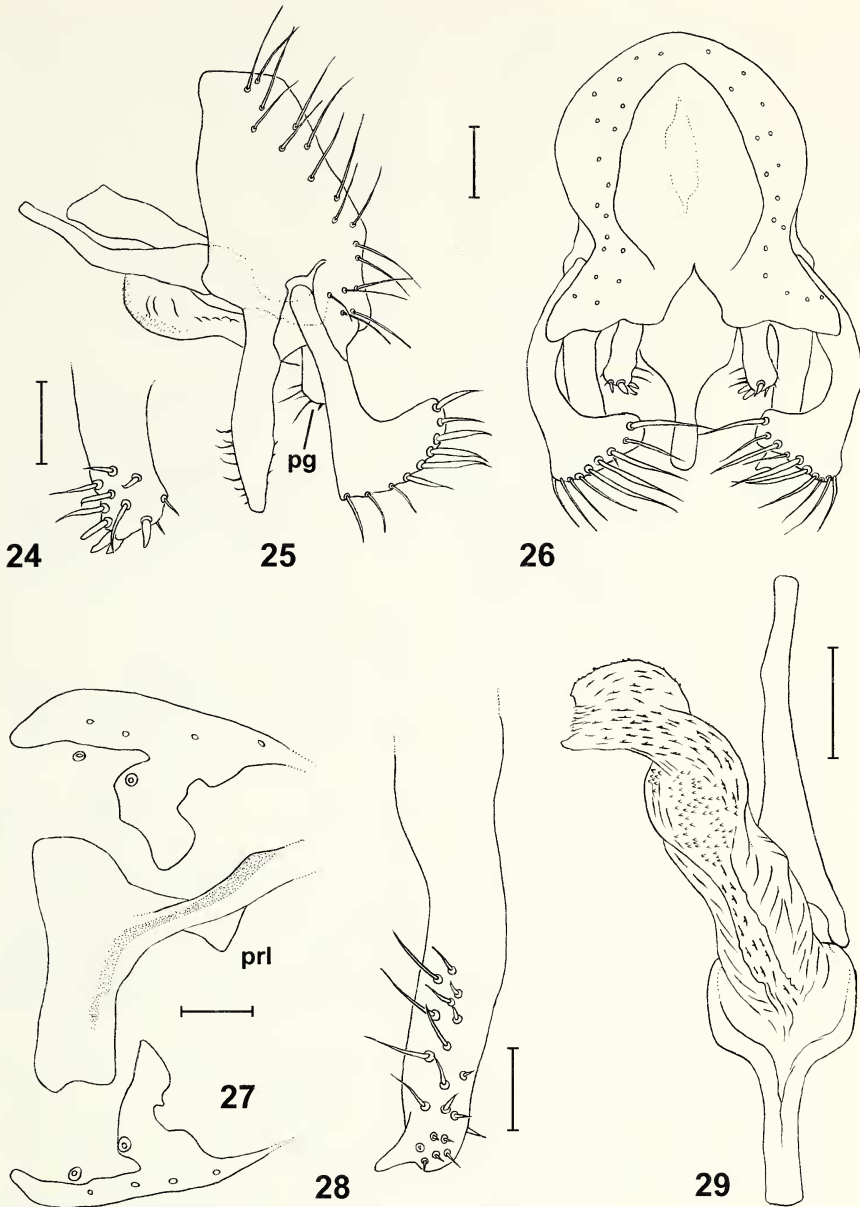
DIAGNOSIS. The male genitalic characters most closely resemble *I. matamata* and *I. pterygion*. From the latter it can easily be distinguished by the simple (not apically expanded) epiphallus. From the former it differs by the contrastingly colored pleuron, the twisted distiphallus, and the chaetotaxy of the surstyli (see *I. matamata* below). The female can be separated from all other species by the peculiar, asymmetrically egg-shaped spermatheca.

ETYMOLOGY. This species is named for the characteristic surstylus, whose regular fringe of long bristles resembles a fan (Gr. *anemosyris*: a kind of fan). The specific name is a noun in apposition.

Inbiomyia matamata Buck sp. nov.

Figs. 4, 30–36

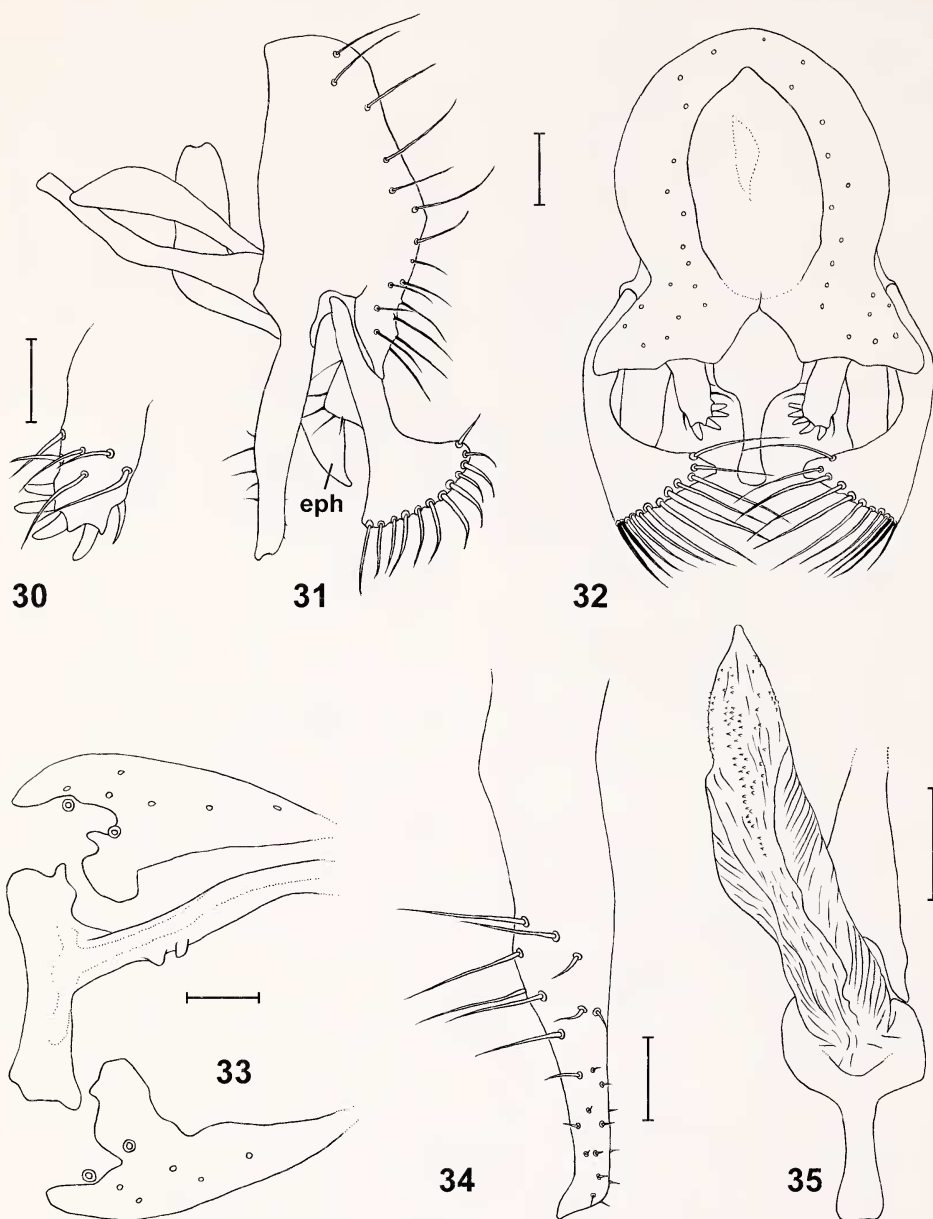
ADULT. Wing length 1.38–1.44 mm (♂), 1.44–1.49 mm (♀). Sclerotized portions of head dark brown excluding prementum, which is pale yellowish brown. Antenna dark brown, concolorous



Figures 24–29 *Inbiomyia anemosyris* Buck sp. nov., male terminalia. 24. Left postgonite, anterior. 25. Hypopygium, left lateral. 26. Ditto, posterior. 27. Segments 5–8, ventral. 28. Left ventral epandrial process, anterior. 29. Phallapodeme and phallus, ventral. Scale 0.05 mm (25–27, 29), 0.025 mm (24, 28). Abbreviations: pg—postgonite, prl—posterior projection of lateral portion of synsternite 5+6+7. Drawings: A. Cormier

ous with frons; palpus slightly paler. Frons beside the strong orbital bristle with 2 orbital hairs and a pair of ocellar setulae. Ocellar plate sparsely microtomentose. Facial sclerotization extending below level of lower facial ridge. Thorax including pleuron dark brown, katepisternum becoming slightly paler anteroventrally. No dorsocentral setulae between postsutural and pre-scutellar dorsocentral bristles; acrostichal rows of hairs extending posteriorly to level of postsutural dorsocentral bristle. Anterior pair of scutellar

setae thin, hairlike, and subequal in length to acrostichals, *ca.* one-fourth as long as posterior pair of scutellars. Legs brownish yellow, forecoxa dark brown at base and concolorous with anepisternum, becoming gradually paler toward pale brown apex. Antero- and posteroventral rows of bristles of forefemur moderately strong and brownish in male; bristles of posteroventral row slightly stronger than anteroventral row. Male foretibia slightly clavate, thickening abruptly in distal half and with a row of well-developed,



Figures 30–35 *Inbiomyia matamata* Buck sp. nov., male terminalia. 30. Left postgonite, anterior. 31. Hypopygium, left lateral. 32. Ditto, posterior. 33. Segments 5–8, ventral. 34. Left ventral epandrial process, anterior. 35. Phallapodeme and phallus, ventral. Scale 0.05 mm (31–33, 35), 0.025 mm (30, 34). Abbreviation: eph—epiphallus. Drawings: A. Cormier

dark, semierect bristles. Wing membrane slightly infusate. $Cs2/Cs3 = 3.0\text{--}3.9$, $Cs3/Cs4 = 2.0\text{--}2.3$.

MALE TERMINALIA (Figs. 30–35). Synsternite 5+6+7 with a small, paired, posterior process on its lateral portion (Fig. 33). Ring-shaped sclerite present but very pale and indistinct. Epandrium brown, posteroventral lobes paler, lacking pair of anterodorsal apodemes. Subanal plate continuous with epandrium but poorly sclerotized. Perianal field (Fig. 32) elliptical,

ventrally not clearly delimited from subanal plate. Ventral epandrial process (Fig. 34) brownish yellow (darker at base), almost straight; apex with a medially directed point; medial surface with several long bristles from one-half to three-fourths; apical fourth with short *sensilla trichodea* only. Surstylus very similar to *I. anemosyris*, but marginal bristles more numerous and closer to each other in anterior half (Fig. 31). Hypandrium broadly and firmly connected to anteroventral margin of epandrium by a tight suture, posteriorly

with a triangular emargination between the 2 arms. Postgonite (Fig. 30) short and yellow, directed ventrally (Fig. 32), with 4–5 stout, blunt-tipped bristles near apex, and several longer bristles with fine tips in distal half. Epiphallus (Fig. 35) yellow, slender, parallel-sided with truncate tip, slightly curved posteriorly in lateral view. Distiphallus (Fig. 35) moderately long and straight, surface ventromedially and in distal half with indistinct short spicules and no microtrichia.

FEMALE TERMINALIA (Fig. 36). Tergite 7 entire, separate from sternite laterally. Sternite 7 evenly pigmented. Tergite 8 with a very small anterior apodeme (Fig. 36: ap), dark brown and concolorous with preceding tergites; its posterior margin convex without medial emargination. Spermatheca weakly sclerotized, pale brown, oval, with lateral invagination and laterally inserted duct.

TYPE MATERIAL. Holotype. ♂, AMNH, VENEZUELA: Amazonas, Río Mavaca Camp, 2°2'N, 65°06'W, 150 m, 16–27.iii.1989, D.A. Grimaldi, Phipps-FUDECI Expedition.

Paratypes. 6♂, 4♀, VENEZUELA: same data as holotype (5♂, AMNH). COLOMBIA: Comisaría Amazonas, Amacayacu National Park, Sector Matamata, 150 m, 20–26.iii.2000 (1♀, UNCB), 3–9.iv.2000 (1♂, 1♀, UNCB; 1♀, LACM), 11–24.iv.2000 (1♀, DEBU), Malaise, A. Felix.

DIAGNOSIS. Closely related to *I. anemosyris*, which has very similar male genitalia, but easily distinguished from it by coloration. In *I. anemosyris* the male foretibia is not clavate, the long bristles on the medial surface of the ventral epandrial process are inserted closer to the apex, the fringe of bristles on the surstylus is less dense in its anterior half, and the distiphallus is twisted apically.

ETYMOLOGY. This species is named after the collecting locality in Colombia (where the first specimen examined by the author was collected). The specific name is used as a noun in apposition.

Inbiomyia pterygion Buck sp. nov.

Figs. 37–44

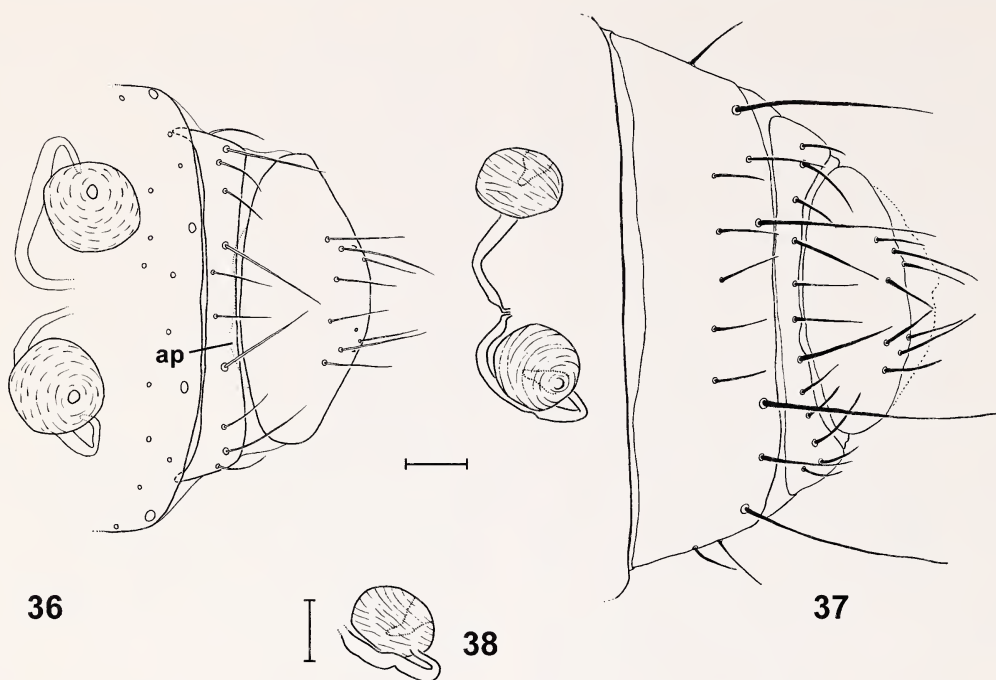
ADULT. Wing length 1.61 (♂), 1.54 mm (♀). Sclerotized portions of head dark brown excluding prementum, which is brownish yellow. Antenna dark brown, nearly concolorous with frons; palpus slightly paler. Frons beside the strong orbital bristle with only 1 exclinate orbital hair; reclinate to inclinate orbital hair(s) apparently broken off. Ocellar plate glossy and lacking microtomentum on each side of ocellar area; ocellar setulae absent. Facial sclerotization extending below level of lower facial ridge. Thorax mostly brown; mesonotum, proepisternum, and anepisternum dark brown; anepimeron and postnotum medium to dark brown; katepisternum and meron medium brown, becoming much paler

(brownish yellow) ventrally. No dorsocentral setulae between postsutural and prescutellar dorsocentral bristles; acrostichal rows of hairs extending posteriorly to level of postsutural dorsocentral bristle. Anterior pair of scutellar setae thin and hairlike, *ca.* one-fourth as long as posterior pair. Legs yellow to brownish yellow, midcoxa with a medium brown streak on posterodorsal surface. Antero- and posteroventral rows of bristles of forefemur strong and black in male; anteroventral row consisting of only 2–3 bristles. Male foretibia slightly clavate, thickening abruptly in distal half and with a row of well-developed, dark, semierect bristles. Wing membrane slightly infusate. $Cs2/Cs3 = 3.1–3.5$, $Cs3/Cs4 = 2.0–2.2$.

MALE TERMINALIA (Figs. 39–44). Synsternite 5+6+7 with a posterior process on its lateral portion (Fig. 42). Ring-shaped sclerite present but faint. Epandrium brown, posteroventral lobes paler, without pair of dorsolateral apodemes. Subanal plate continuous with epandrium but poorly sclerotized. Perianal field (Fig. 41) roughly elliptical, ventral margin not clearly delimited from subanal plate. Ventral epandrial process (Fig. 43) brownish yellow (darker at base), very similar to *I. anemosyris*, completely fused to epandrium (Fig. 40), almost straight and apically blunt in lateral view; medial surface with bristles in apical half; apex with a field of *sensilla trichodea* and a small, medially directed point. Surstylus brownish yellow, marginal fringe of bristles arranged in a regular row, bristles of this row broadly spaced anteriorly (Fig. 40). Hypandrium broadly and firmly connected to anteroventral margin of epandrium by a tight suture, posteriorly with a relatively small emargination between the 2 arms (as in Buck, 2006: fig. 4E). Postgonite (Fig. 39) short and yellow, directed ventrally (Fig. 41), with *ca.* 4 stout, blunt-tipped bristles near apex and several longer bristles with fine tips in distal two-fifths. Basiphallus yellow. Epiphallus (Fig. 44) expanded distally, apical margin with small median emargination. Distiphallus (Fig. 44) moderately long, twisted distally, and curved toward right side, surface in distal half and ventromedially with indistinct short spicules and no microtrichia.

FEMALE TERMINALIA (Figs. 37, 38). Tergite 7 not divided, touching sternite laterally but not fused to it. Sternite 7 evenly sclerotized. Tergite 8 without anterior apodeme, dark brown, slightly paler than preceding tergites. Sternite 8 small, very faintly sclerotized and hardly darker than surrounding membrane, medially divided. Spermatheca as in *I. matamata*, weakly sclerotized, pale brown, oval, with lateral invagination and laterally inserted duct (Fig. 38).

EGG. Abdomen of paratype contained 2 nearly mature eggs. Eggs larger than in other species (length 0.48 mm, width 0.27 mm), otherwise very similar to *I. acmophallus* (see Fig. 11).



Figures 36–38 *Inbiomyia* spp., females. 36. *I. matamata* Buck sp. nov., terminalia and spermathecae, dorsal. 37. *I. pterygion* Buck sp. nov., terminalia and spermathecae, dorsal. 38. Ditto, spermatheca, lateral. Scale 0.05 mm. Abbreviation: ap—anterior apodeme of tergite 8. Drawings: A. Cormier (36) and M. Musial (37, 38)

TYPE MATERIAL. *Holotype*. ♂, CBFC, BOLIVIA: Departamento La Paz, Mapiri, Arroyo Tuhiri, 10.iv.2001, Malaise, B.V. Brown and G. Kung.

Paratype. ♀, DEBU, BOLIVIA: Departamento La Paz, Arroyo Tuhiri W Mapiri, 15°17'27"S, 68°15'29"W, 10.iv.2001, S.A. Marshall.

DIAGNOSIS. The male genitalia of this species closely resemble *I. anemosyris* with exception of the distally expanded epiphallus, which is similar to *I. acmophallus*. It can be distinguished from the latter by the elliptical perianal field, the surstylus, which has its fringe of marginal bristles arranged in a regular row, and the ventral epandrial process, which lacks blunt-tipped medial bristles.

ETYMOLOGY. This species is named for the peculiar shape of its epiphallus, which resembles the tail fin of a cetacean (Gr. *pterygion*: fin). The species name is used as a noun in apposition.

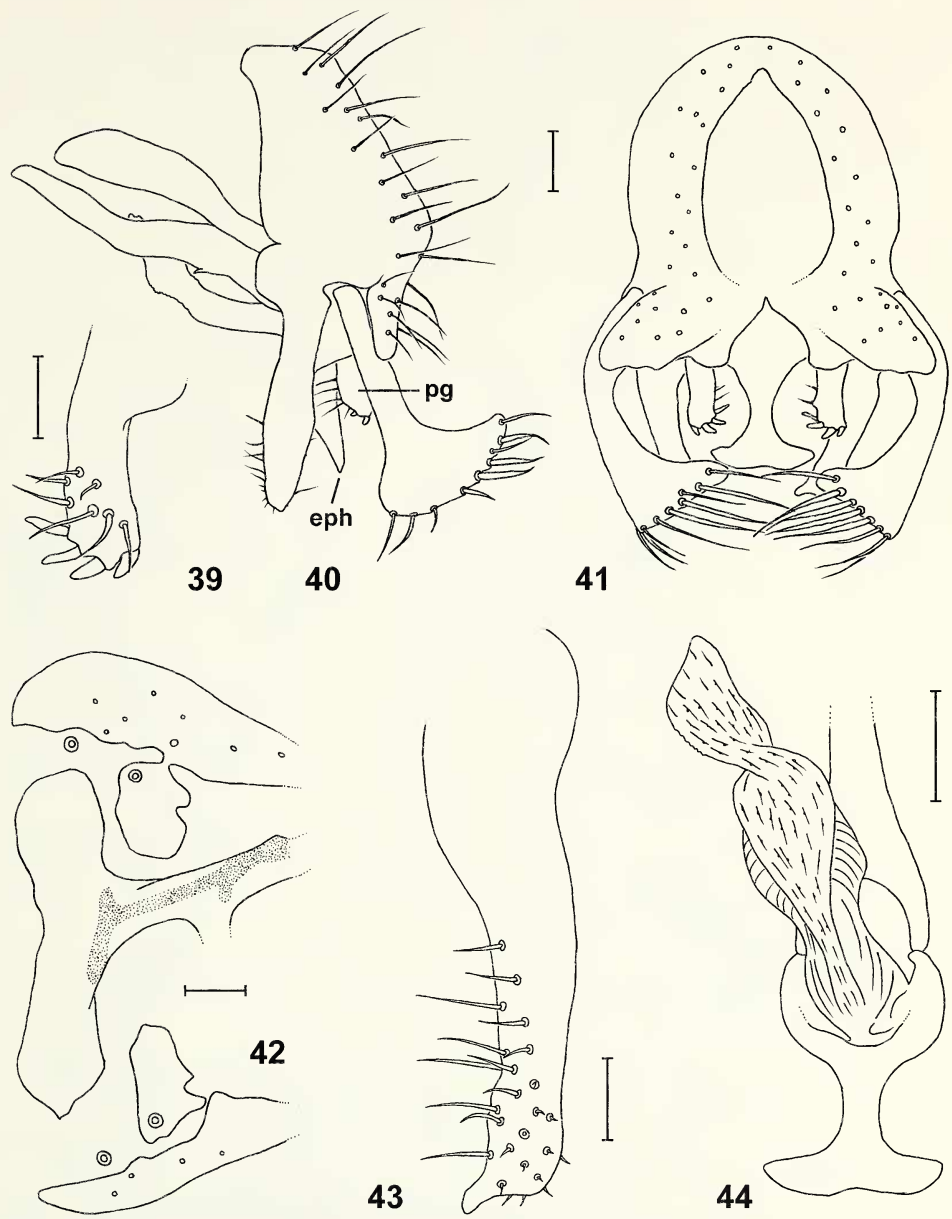
Inbiomyia regina Buck sp. nov.

Figs. 7, 45–51

ADULT. Wing length 1.54–1.56 mm (♂), 1.61–1.64 mm (♀). Sclerotized portions of head dark brown excluding prementum, which is yellow to brownish yellow. Antenna dark brown, almost concolorous with frons; palpus slightly paler. Frontal orbit with 2–3 hairs in addition to strong bristle. Ocellar plate polished, without microtomentum except between ocelli. Facial

sclerotization extending below level of lower facial ridge. Thorax distinctly bicolored. Lower pleuron yellow, proepisternum and anepisternum (excluding posteroventral corner) dark brown (concolorous with scutum); anterior two-thirds of anepimeron and posteroventral corner of anepisternum yellow to brownish yellow; posterior third of anepimeron, postnotum medium brown; area around suture between anepimeron and katatergite somewhat darker. No dorsocentral setulae between postsutural and prescutellar dorsocentral bristles; acrostichal rows of hairs extending posteriorly slightly beyond level of transverse suture. Scutellum with a small anterior pair of hairs, subequal in size to acrostichal hairs. Legs including forecoxa brownish yellow. Antero- and posteroventral rows of bristles of forefemur stronger and darker in male than in female; bristles of posteroventral row slightly stronger than anteroventral row in both sexes. Male foretibia slightly clavate, with distinctly enlarged, erect to semierect, dark, ventral bristles (Fig. 7). Wing membrane slightly infusate. $Cs2/Cs3 = 3.1\text{--}3.5$, $Cs3/Cs4 = 1.9\text{--}2.3$.

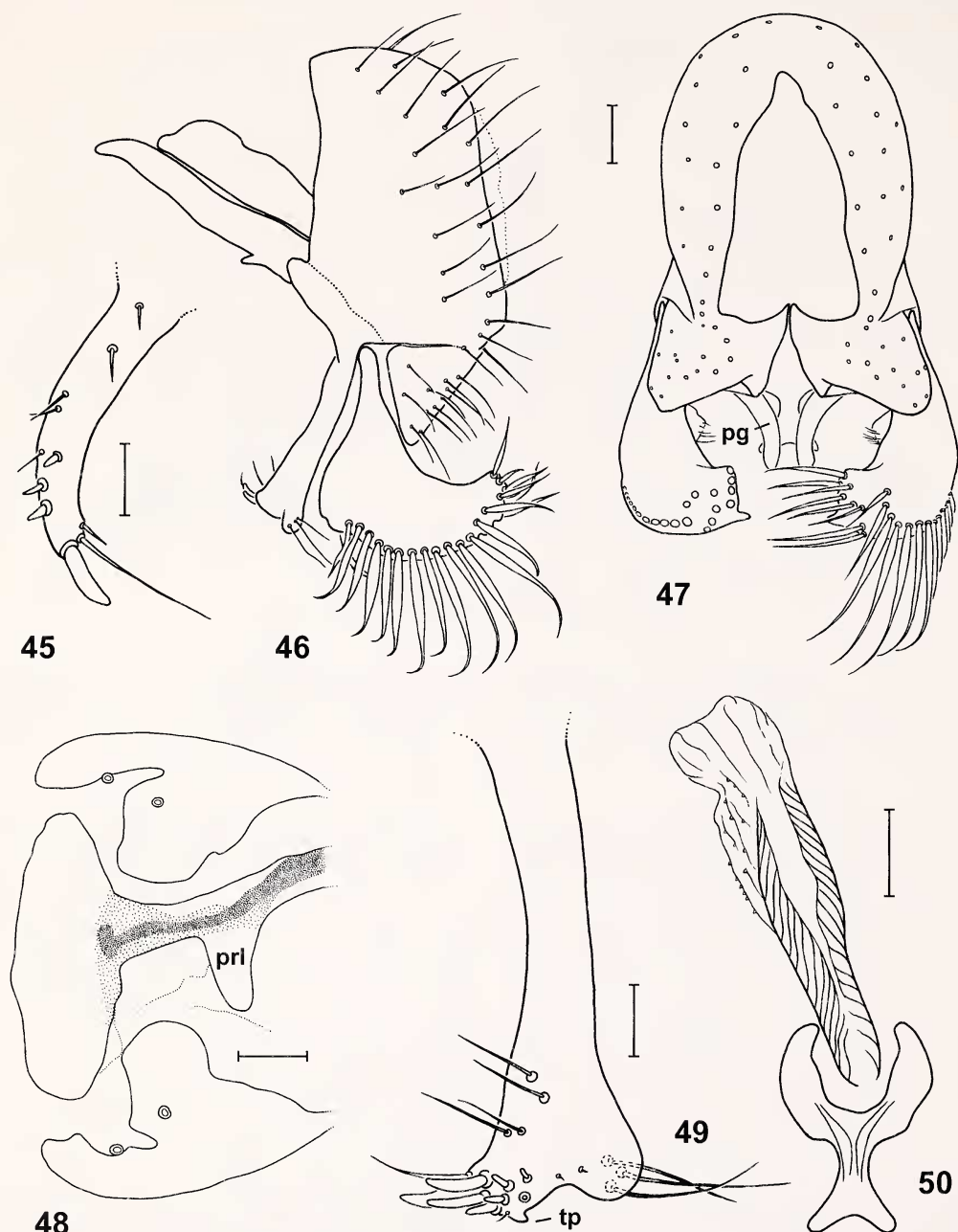
MALE TERMINALIA (Figs. 45–50). Synternite 5+6+7 with large posterior process on lateral portion (Fig. 48: prl). Ring-shaped sclerite present. Epandrium (Fig. 46) dark brown, posteroventral lobes paler; pair of anterodorsal apodemes not developed. Subanal plate continuous with epandrium, weakly sclerotized. Perianal field



Figures 39–44 *Inbiomyia pterygion* Buck sp. nov., male terminalia. 39. Left postgonite, anterior. 40. Hypopygium, left lateral. 41. Ditto, posterior. 42. Segments 5–8, ventral. 43. Left ventral epandrial process, anterior. 44. Phallapodeme and phallus, ventral. Scale 0.05 mm (40–42, 44), 0.025 mm (39, 43). Abbreviations: eph—epiphallus, pg—postgonite. Drawings: A. Cormier

ventrally with parallel to slightly divergent lateral margins (Fig. 47). Ventral epandrial process (Fig. 49) brownish yellow (darker at base), completely fused to epandrium, with conspicuously expanded bilobate apex; median apical lobe with a series of stout blunt-tipped bristles becoming gradually shorter laterally and a minute ventral toothlike angle (Fig. 49: tp); lateral apical lobe with a few long hairs on outer surface. Surstylus (Figs. 46, 47) brownish yellow, with

a small toothlike apical angle; marginal fringe of bristles arranged in a row that doubles and triples for a short distance posteriorly; anteriormost of these bristles directed medially; bristles conspicuously flattened and slightly expanded in basal half. Hypandrium broadly connected to antero-ventral margin of epandrium by a tight suture, posteriorly with a relatively small emargination between the 2 arms (as in Buck, 2006: fig. 4E). Postgonite (Fig. 45) yellow, unusually long and



Figures 45–50 *Inbiomyia regina* Buck sp. nov., male terminalia. 45. Left postgonite, anterior. 46. Hypopygium, left lateral (phallus omitted). 47. Ditto, posterior (bristles of postgonites and left surstylus omitted). 48. Segments 5–8, ventral. 49. Right ventral epandrial process, posteromedial. 50. Phallus, ventral. Scale 0.05 mm (46–48, 50), 0.025 mm (45, 49). Abbreviations: pg—postgonite, prl—posterior projection of lateral portion of synsternite 5+6+7, tp—toothlike process. Drawings: M. Musial

slender, evenly curved outward, directed ventrally (Fig. 47: pg), with a blunt-tipped apical bristle, a long preapical hair, and several shorter hairs and peglike bristles on posterior and medial surface. Epiphallus (Fig. 50) brown, Y-shaped with slender stem in posterior view, apically flattened with stout base in lateral view. Dis-

tiphallus (Fig. 50) moderately long; its surface in distal half and ventromedially with indistinct short spicules and no microtrichia.

FEMALE TERMINALIA (Fig. 51). Tergite 7 entire, separate from sternite laterally. Sternite 7 unevenly pigmented, dark laterally and medially (especially anteromedially). Tergite 8 with very

short anterior apodeme (Fig. 51: ap), dark brown and almost as dark as preceding tergites; its posterior margin convex without medial emargination. Spermatheca weakly sclerotized, pale brown, tire-shaped with small central invagination and laterally inserted duct.

EGG. Length 0.48 mm, width 0.27 mm. Overall shape very similar to *I. zeugodonta* (Fig. 12) but micropylar elevation less prominent. Upper surface coarsely granulose (microreticulate under high magnification), polygonal (macro-)reticulation moderately developed.

TYPE MATERIAL. Holotype. ♂, LACM [LACM ENT 213191], FRENCH GUIANA: Regina, Kaw Mt., Patawa, 4.54°N, 52.15°W, 400 m, iii.2005, Malaise, J.A. Cerda.

Paratypes. 3 ♂, 5 ♀. Same data as holotype (1 ♂, 2 ♀, LACM), same except iv.2005 (1 ♂, 2 ♀, LACM; 1 ♂, 1 ♀, DEBU).

DIAGNOSIS. The male and female genitalic characters of this species are similar to *I. acmophallus*, whereas body coloration and facial sclerotization resembles *I. anemosyris*. The bilobate apex of the ventral epandrial process, the outwardly curved, slender postgonites, and the characteristic surstylus immediately distinguish the male of *I. regina* from all other species. The female can be recognized by the combination of an unevenly pigmented sternite 7, glossy ocellar plate (devoid of microtomentum), and bicolored pleuron.

ETYMOLOGY. The species name is a noun in apposition and based on the name of the type locality.

Inbiomyia exul species group

SPECIES INCLUDED. *Inbiomyia exul* sp. nov. and *Inbiomyia* sp. 1.

DIAGNOSIS. Inner vertical bristle at most half as long as orbital bristle. Facial sclerotization very extensive, extending ventrally more than halfway the distance between lower facial ridge and clypeal margin (Fig. 6). No dorsocentral setulae between postsutural and prescutellar dorsocentral bristles. R_{2+3} shortened, $Cs2/Cs3 < 2.5$. The male genitalia are highly unusual and strikingly different from other species groups. Ventral epandrial process connected narrowly to epandrium. Surstylus tapered toward apex, with short, blunt, toothlike, apical bristle. Base of surstyli meeting medially below anus, subanal plate and posteroventral lobes of epandrium not developed. Hypandrium with long, Y-shaped ventral process. Postgonite absent. Epiphallus broad, shieldlike, with striate surface. Distiphallus without microtrichia.

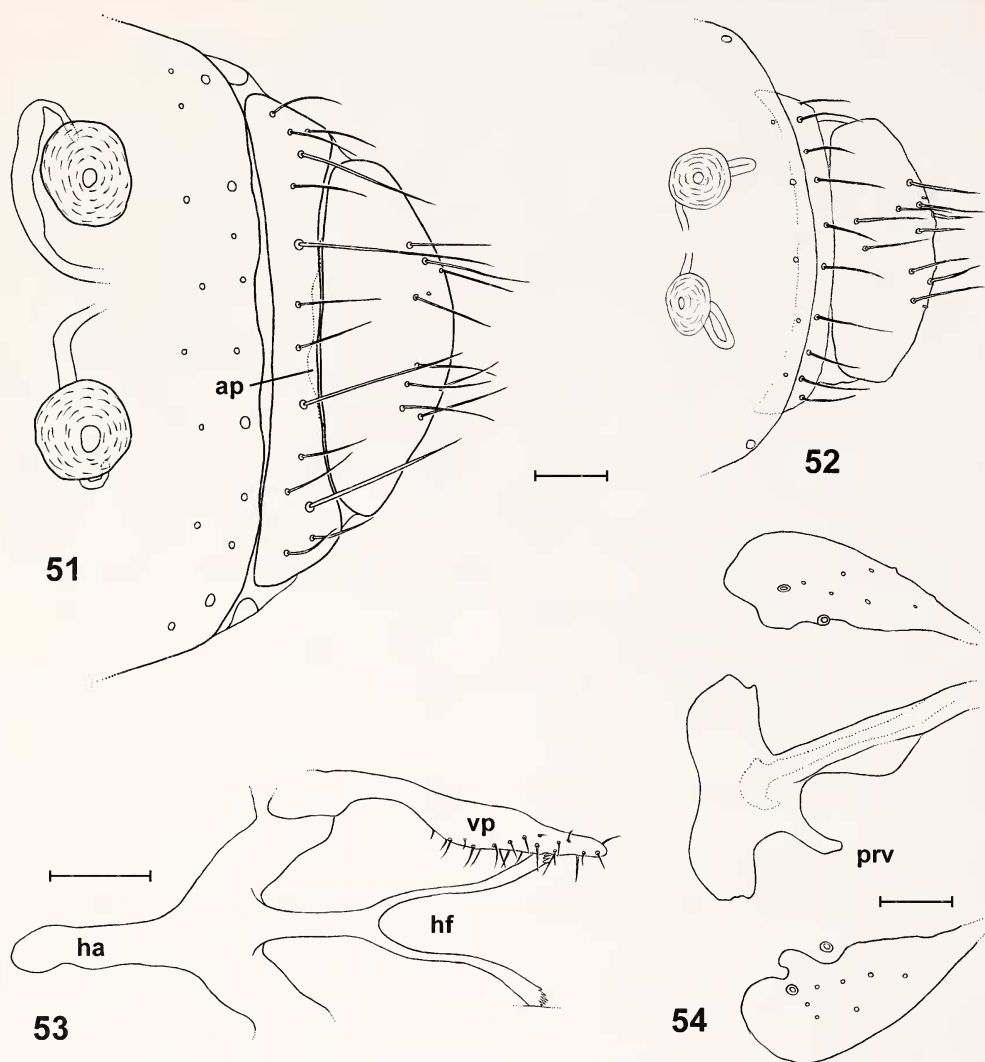
Inbiomyia exul Buck sp. nov.

Figs. 1, 6, 9, 13, 52–60

ADULT (Fig. 1). Wing length 1.31–1.56 mm (♂), 1.36–1.64 mm (♀). Sclerotized portions of

head dark brown excluding prementum, which is yellow. Antenna dark brown, almost concolorous with frons; palpus slightly paler. Frontal orbit with 2 hairs in addition to strong bristle. Ocellar plate glossy, lacking microtomentum; ocellar setulae absent. Thorax distinctly bicolored. Lower pleuron yellow to almost white, whole upper pleuron from proepisternum to anatergite dark brown and concolorous with scutum. Acrostichal rows of hairs extending posteriorly slightly beyond level of transverse suture. Scutellum with a small anterior pair of hairs, subequal in size to acrostichal hairs. Legs including forecoxa yellow. Posteroventral row of bristles of forefemur distinctly stronger and darker in male than in female. Posteroventral row distinctly stronger and darker than anteroventral row in male, only slightly stronger in female. Ventral row of short, semierect bristles in distal half of male foretibia weakly developed and inconspicuous but better developed than in female. Wing (Fig. 9) with slightly infusate membrane. $Cs2/Cs3 = 1.4\text{--}1.8$, $Cs3/Cs4 = 2.7\text{--}3.5$.

MALE TERMINALIA (Figs. 53–60). Synsternite 5+6+7 with a long posterior process on its ventral portion (Fig. 54: prv), lateral portion distinctly expanded near base. Ring-shaped sclerite reduced. Epandrium, surstylus, and epiphallus brown. Epandrium lacking pair of dorsolateral apodemes. Posteroventral epandrial lobes absent. Subanal plate absent or its remnants incorporated into medial base of surstylus. Perianal field (Fig. 57) expanding ventrally, extending between posteroventral margin of epandrium and base of surstylus. Ventral epandrial process separate from epandrium except at anterior corner, which is also the articulation point of the hypandrium (Fig. 56). Ventral epandrial process (Figs. 53, 58) dilated and curved posteriorly in distal half; distal half laterally embraced by surstylus; its medial surface with scattered short bristles. Surstylus (Fig. 56) with broad base, slightly narrowed toward more or less truncate apex, bent posteriorly beyond middle; medially with a small setulose lobe near base (Fig. 59); basal half with *ca.* 4 long bristles posteriorly; apex with a ventral peglike bristle and several long incurved bristles. Hypandrium (Figs. 53, 56) of most unusual shape; ventrally with a long forked process that arises at the base of the posterolateral arms; apex of the prongs of this fork dilated and with finely crenulate margin (Fig. 55), which comes close to or touches the medial face of the ventral epandrial process; posterolateral arms of hypandrium with broad emargination between them; hypandrium articulated to anteroventral corner of epandrium anteriorly and to medial base of surstylus posteriorly. Postgonite absent. Epiphallus (Fig. 60) shieldlike, with blunt apex and fine wrinkles on disk. Distiphallus (Fig. 60) straight and relatively short, ventral surface with long microtrichia at least in basal half and no spicules.



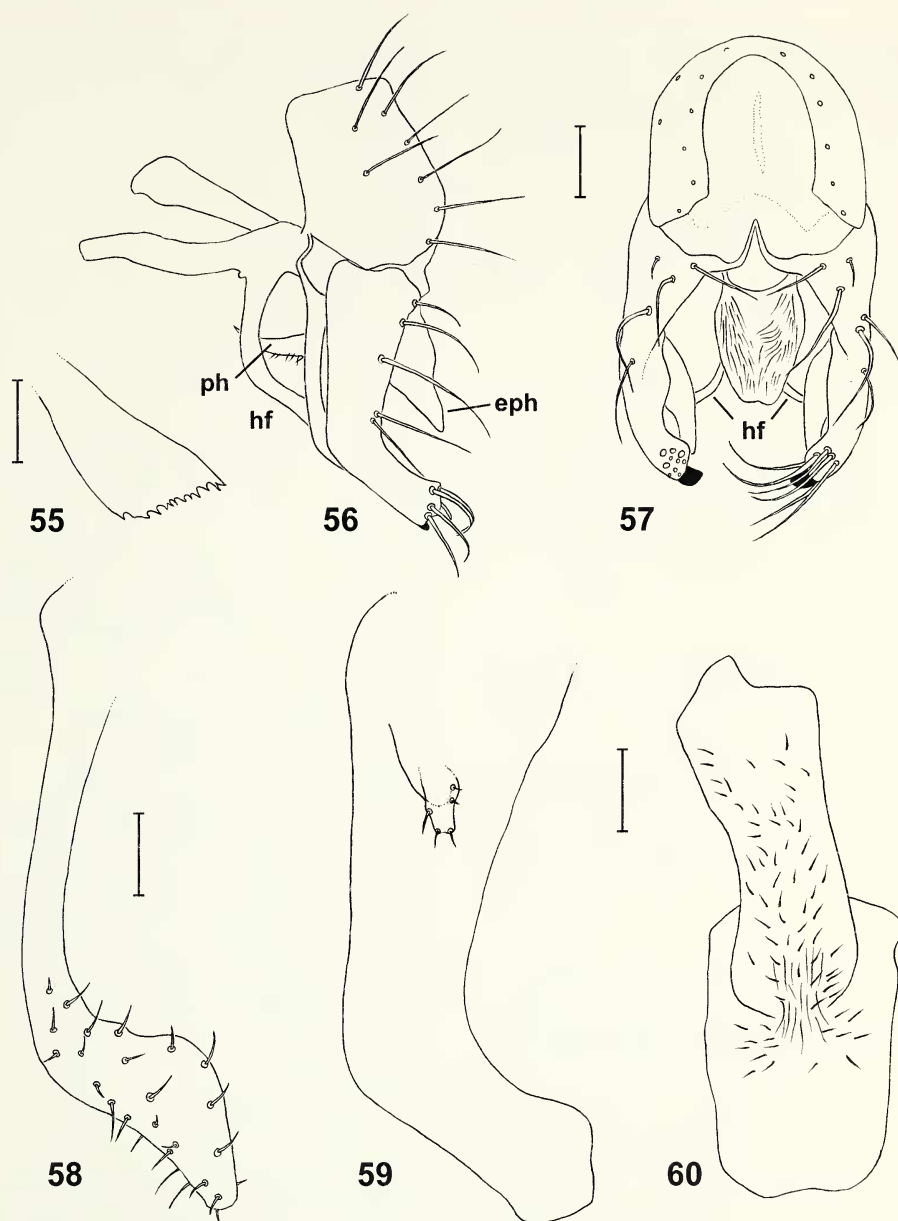
Figures 51–54 *Inbiomyia* spp., terminalia. 51. *I. regina* Buck sp. nov., female terminalia and spermathecae, dorsal. 52. *I. exul* Buck sp. nov., female terminalia and spermathecae, dorsal. 53. Ditto, hypandrium and left ventral epandrial process, ventral. 54. Ditto, male segments 5–8, ventral. Scale 0.05 mm. Abbreviations: ap—anterior apodeme of tergite 8, ha—hypandrial apodeme, hf—hypandrial fork, prv—posterior process of ventral portion of synsternite 5+6+7, vp—anteroventral process of epandrium. Drawings: M. Musial (51) and A. Cormier (52–54)

FEMALE TERMINALIA (Fig. 52). Tergite 7 entire, relatively long medially, not fused to sternite laterally. Sternite 7 evenly pigmented. Tergite 8 without anterior apodeme, dark brown and concolorous with preceding tergites; its posterior margin convex with very small and shallow median emargination. Spermatheca moderately sclerotized, pale brown, tire-shaped with small central invagination and laterally inserted duct.

EGG (Fig. 13). Relatively large compared to body size (length 0.45 mm, width 0.27 mm); length/width ratio lower than in other species. Micropylar elevation low, polygonal pattern of upper surface faint, otherwise as in generic description.

TYPE MATERIAL. Holotype. ♂, INBC, COSTA RICA: Prov. Puntarenas, Golfito, Corcovado National Park, Los Patos Biological Station, trail to Sirena, 70 m, 25.xii.2000–23.ii.2001, Malaise, L_S_509200_275700, #61323, J. Azofeifa.

Paratypes. 9♂, 11♀, COSTA RICA: Prov. Puntarenas, Golfito, Corcovado National Park, Los Patos Biological Station, 160 m, 9.ix–9.x.2001, Malaise, K. Caballero (2♂, INBC); Corcovado National Park, Cerro Puma, 100–300 m, 19.vi.18.vii.2003, Malaise #3, M. Moraga, A. Azofeifa, and K. Caballero (1♂, INBC); Corcovado National Park, Cerro Rincón, La Tigrilla, 600 m, 7.ii–23.iv.2002, Malaise, J. Azofeifa Zúñiga (1♀, INBC); Corcovado National Park, 800 m N of Cerro Quebraditos, 782 m,



Figures 55–60 *Inbiomyia exul* Buck sp. nov., male terminalia. 55. Apex of prong of hypandrial fork, lateral. 56. Hypopygium, left lateral. 57. Ditto, posterior. 58. Right ventral epandrial process, inner surface. 59. Right surstylus, inner surface. 60. Phallus, ventral. Scale 0.05 mm (56, 57), 0.025 mm (55, 58–60). Abbreviations: eph—epiphallus, hf—hypandrial fork, ph—phallus. Drawings: A. Cormier

23.iv–24.vi.2002, Malaise, J. Azofeifa (2♀, INBC); Osa Peninsula, Corcovado National Park, San Pedrillo, 12–14.viii.2001, yellow pans in garden compost, M. Buck (1♀, DEBU); same data except yellow pans in treefall (2♂ [abdomen missing], DEBU); Osa Peninsula, 2.5 km S Rincón, 8°42'1"N, 83°30'50"W, ~50 m, pans in grassy area at forest margin, 10–11.viii.2001, K.N. Barber (1♂, DEBU); Osa Peninsula, Golfo Dulce Forest Res., 3 km SW Rincón, 10 m,

vi.1992, P. Hanson (1♀, DEBU); Osa Peninsula, 23 km N Puerto Jiménez, La Palma, 10 m, xi–xii.1992, P. Hanson (1♀, DEBU); Osa Peninsula, 5 km N Puerto Jiménez, 10 m, vii.1992, P. Hanson (1♀, DEBU); Las Alturas, 8°57'N, 82°58'W, 1500 m, i.1992, P. Hanson (1♂, 1♀, DEBU). Prov. Limón, Cahuita, Reserva Chimuri, trail near cabins, 15 m, 8–9.vi.2000, Malaise, Spinelli, Grogan, Borkent and Picado (1♂, 1♀, INBC); R.B. Hitoy Cerere, V. La Estrella, Sendero

Espavel, 560 m, 18.ix–5.x.2003, Malaise, Gamboa, Rojas and Arana (1 ♀, INBC). Prov. Cartago, Barbilla National Park, trail to Valle Escondido, 2 km S Río Dantas, 700–800 m, 29.vi–29.vii.2000, Malaise, E. Rojas (1 ♀, INBC). ECUADOR: Prov. Pichincha, Río Palenque Sci. Centre, 1–14.vii.1975, A. Forsyth (1 ♂, CNCI).

DIAGNOSIS. This species differs from all other species by the contrastingly bicolored pleuron, the presence of a forked, ventral hypandrial process and the absence of postgonites. One undescribed species from Guatemala that is known from 1 female only (see sp. 1 below) shares the distinctive pleural coloration and probably has similar male genitalia.

ETYMOLOGY. *Inbiomyia exul* has highly unusual male genitalia that are unique within the genus. The species name, which is used as a noun in apposition, refers to the wide morphological gap between *I. exul* and other species of the genus (*I. exul*: banished person).

Inbiomyia sp. 1

MATERIAL EXAMINED. GUATEMALA: Departamento Zacapa, 3.5 km SE La Unión, 1500 m, 23–25.vi.1993, flight intercept trap, J. Ashe and R. Brooks (♀, DEBU).

REMARKS. Very similar to *I. exul*, wing length 1.65 mm. Differences from *I. exul* include different costal ratios ($Cs2/Cs3 = 2.2$, $Cs3/Cs4 = 2.5$), tergite 8 with a small basomedial desclerotized area, and spermatheca with a broader central invagination.

Inbiomyia mcalpineorum species group

SPECIES INCLUDED. *Inbiomyia empheres* sp. nov., *I. mcalpineorum* Buck, and *Inbiomyia* sp. 2.

DIAGNOSIS. Inner vertical bristle *ca.* $0.65\times$ as long as orbital bristle (Fig. 3). Face not sclerotized below lower facial ridge (Fig. 3). 1–3 dorsocentral setulae between postsutural and prescutellar dorsocentral bristles. R_{2+3} long, $Cs2/Cs3 > 3.0$. Epandrium with a pair of anterodorsal apodemes (Fig. 62: ap); ventral epandrial process articulated to epandrium. Subanal plate strongly sclerotized; perianal field elliptical. Distal portion of surstylus moderately expanded, with marginal row of bristles and 0–1 discal bristles. Postgonite relatively long, with distinctly dilated apex bearing a marginal row of at least 8 short, blunt, peglike bristles.

Inbiomyia empheres Buck sp. nov.

Figs. 61–66, 80

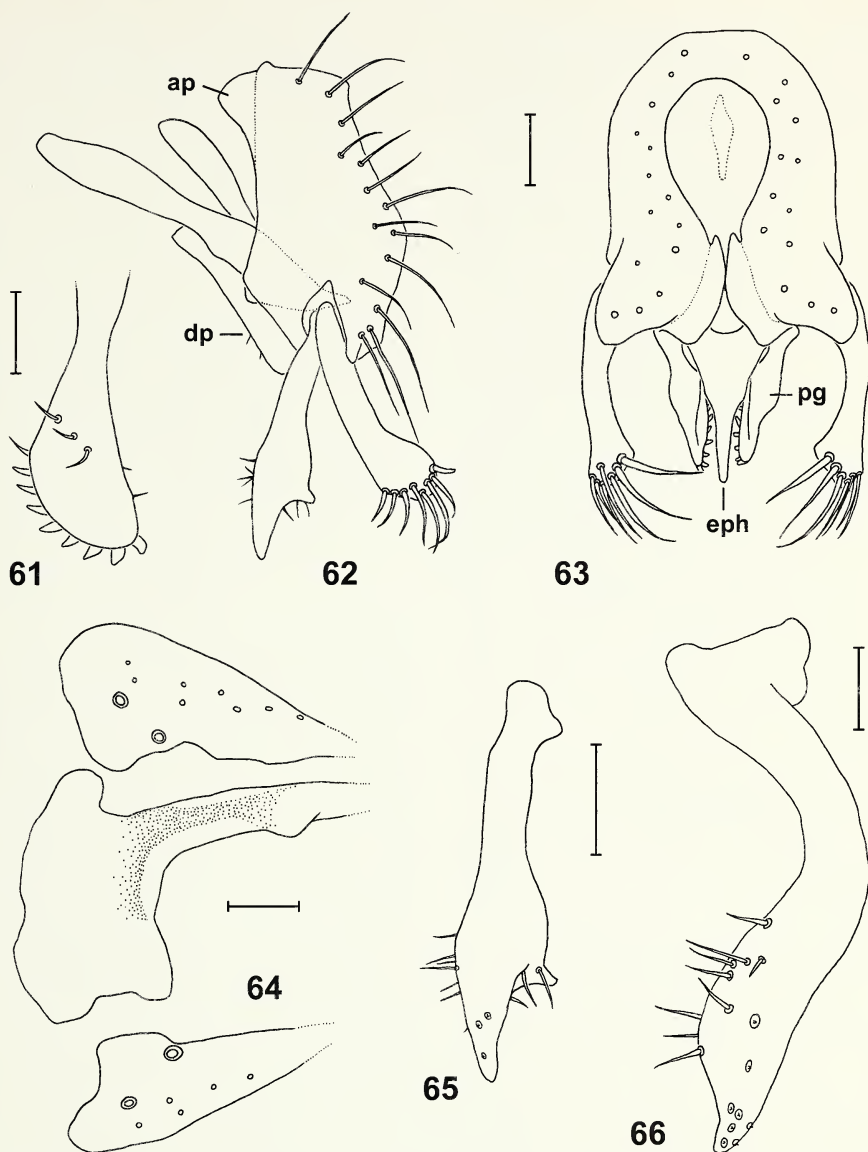
ADULT. Wing length 1.71 (♂), 1.94 mm (♀). Sclerotized portions of head dark brown excluding prementum, which is pale brown. Antenna and palpus dark brown, almost concolorous with frons. Frons, besides usual long inclinate orbital bristle, with 2–3 orbital setulae and a pair of ocellar setulae. Ocellar plate sparsely microto-

mentose. Thorax including pleuron dark brown, katepisternum slightly and gradually becoming paler ventrally. Acrostichal rows of hairs extending posteriorly to about halfway level between posterior 2 pairs of dorsocentrals. Scutellum with anterior pair of bristles small and subequal to acrostichal hairs. Legs brownish yellow, forecoxa slightly darkened in holotype. Both antero- and posteroventral rows of bristles of forefemur darker and slightly stouter in male than in female; bristles of posteroventral row longer in female. Distal three-fourths of male foretibia with well-developed row of short, semierect, black, ventral bristles. Wing very slightly infusate. $Cs2/Cs3 = 3.8$ – 3.9 , $Cs3/Cs4 = 1.6$ – 1.7 .

MALE TERMINALIA (Figs. 61–66). Synsternite 5+6+7 lacking posterior process on its ventral portion, but with a low process on lateral portion (Fig. 64). Ring-shaped sclerite well developed. Epandrium dark brown, ventrally continuous with subanal plate, which is well sclerotized and concolorous with epandrium. Subanal plate forming an obtuse angle with epandrium in lateral view (Fig. 62). Perianal field (Fig. 63) more tapering ventrally than in *I. mcalpineorum*. Ventral epandrial process (Fig. 65) dark brown (excluding paler apex), articulated to a condylelike process of the epandrium, stouter and more strongly curved inwardly than in *I. mcalpineorum*, and with a posterior projection in distal third. Surstylus (Fig. 62) yellowish brown (excluding darker base), marginal fringe of bristles arranged in a somewhat irregular row, disk with 1 bristle on outer surface. Hypandrium narrowly articulated with anteroventral corner of epandrium, with broad emargination between posterior arms. Postgonite (Fig. 61) similar to *I. mcalpineorum* (with slender stem and dilated apex) but directed ventrally (Fig. 63) and anterior margin less angulate in lateral view; anterior margin of dilated portion bearing row of *ca.* 9 marginal bristles that become gradually stouter and more peglike distally. Epiphallus long and slender, gradually tapering toward apex (Fig. 63: eph), straight in lateral view. Distiphallus without microtrichia ventrally and with fewer spicules than in *I. mcalpineorum*.

FEMALE TERMINALIA (Fig. 80). Tergite 7 gradually desclerotized toward midline and becoming very narrow, appearing interrupted, laterally not fused to sternite. Sternite 7 evenly pigmented. Tergite 8 without anterior apodeme, slightly paler than preceding tergites (excluding heavily sclerotized anterior margin), posterior margin convex, without median emargination. Spermatheca as in *I. mcalpineorum*, well-sclerotized, dark brown, tire-shaped with small central invagination and laterally inserted duct.

TYPE MATERIAL. Holotype. ♂, CNCI, ECUADOR: Prov. Napo, El Chaco, 2000 m, 15–23.ii.1983, Malaise, L. Masner and M. Sharkey.



Figures 61–66 *Inbiomyia empheres* Buck sp. nov., male terminalia. 61. Left postgonite, outer surface. 62. Hypopygium, left lateral. 63. Ditto, posterior. 64. Segments 5–8, ventral. 65. Left ventral epandrial process, lateral. 66. Left ventral epandrial process, anterior. Scale 0.05 mm (62–65), 0.025 mm (61, 66). Abbreviations: ap— anterior apodeme of epandrium, dp—distiphallus, eph—epiphallus, pg—postgonite. Drawings: A. Cormier

Paratype. ♀, same data as holotype.

DIAGNOSIS. Closely related to *I. mcalpineorum* but differs from that species by the differently shaped epandrium (less angulate between posterior margin and subanal plate in lateral view), ventral epandrial process (stouter and with tubercle on anterior surface), and the ventrally directed postgonites (directed anteriorly in *I. mcalpineorum*). The female can be recognized by the free tergite 7 (not fused to sternite).

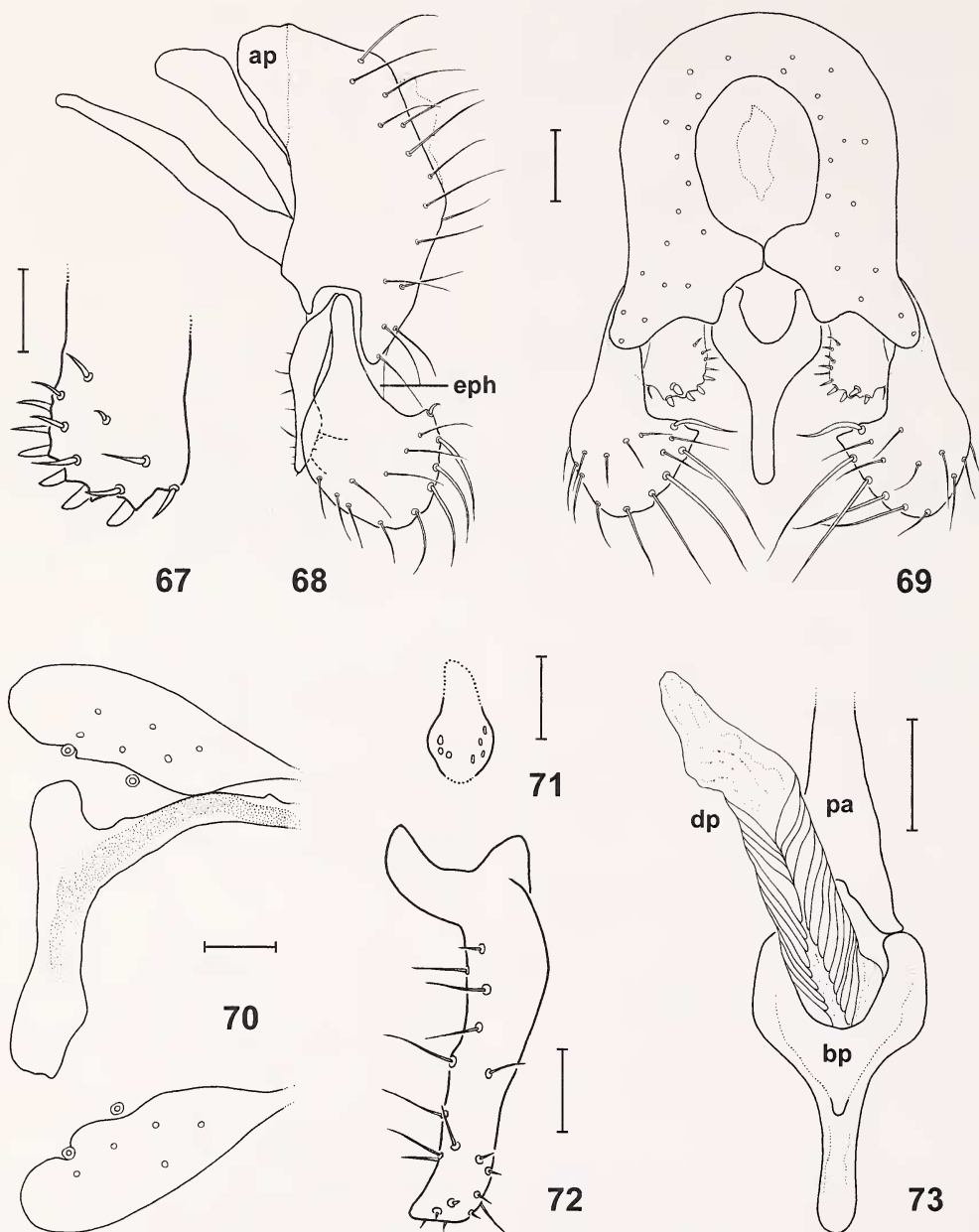
ETYMOLOGY. This species is named for its extreme likeness to *I. mcalpineorum* (Gr. *em-*

pheres: resembling, like). The species name is not latinized and therefore indeclinable.

Inbiomyia mcalpineorum Buck, 2006

I. mcalpineorum Buck, 2006: 379 (figs. 1, 3, 4A–C, F, 5A, 6, 7, 9C, 10G, 11G).

DIAGNOSIS. This species is very similar to *I. empheres*, from which it is distinguished mainly by genitalic characters (see diagnosis of *I. empheres* above). For a detailed description of *I. mcalpineorum*, see Buck (2006).



Figures 67–73 *Inbiomyia anodonta* Buck sp. nov., male terminalia. 67. Left postgonite, anterior. 68. Hypopygium, left lateral. 69. Hypopygium, posterior. 70. Segments 5–8, ventral. 71. Ejaculatory apodeme. 72. Left ventral epandrial process, anterior. 73. Phallus and base of phallapodeme, ventral. Scale 0.05 mm (68–70, 73), 0.025 mm (67, 71, 72). Abbreviations: ap—anterior apodeme of epandrium, bp—basiphallus, dp—distiphallus, eph—epiphallus, pa—phallapodeme. Drawings: M. Musial

DISTRIBUTION. Recorded from all Costa Rican provinces between 560 and 1750 m altitude (Buck, 2006).

Inbiomyia sp. 2

MATERIAL EXAMINED. BOLIVIA: Departamento La Paz, Chulumani, Apa-Apa Reserve, 2000 m, 1–3.iv.2001, Malaise, B.V. Brown and G. Kung (♀, LACM).

REMARKS. Large, wing length 2.02 mm. This specimen agrees with *I. empherus* morphologically, including the incompletely divided tergite 7 (the terminalia were not dissected). However, the femora and forecoxa are distinctly darker and the katapisternum is unicolorous (not paler ventrally). Based on morphology and the high elevation, where this specimen was collected, it is very likely that it belongs to the *I. mcalpineorum* species group.

Inbiomyia scoliostylus species group

SPECIES INCLUDED. *Inbiomyia anodonta* sp. nov., *I. scoliostylus* sp. nov., *I. zeugodonta* sp. nov., and probably *Inbiomyia* sp. 3.

DIAGNOSIS. Inner vertical bristle $0.75\text{--}0.95\times$ as long as orbital bristle (unknown for *I. anodonta*). Face not sclerotized below lower facial ridge. 1–3 dorsocentral setulae between postsutural and prescutellar dorsocentral bristles. R_{2+3} long or short, $Cs2/Cs3 = 2.2\text{--}3.9$. Subanal plate well sclerotized; perianal field elliptical. Ventral epandrial process articulated to epandrium. Expanded apical portion of surstylus with discal bristles. The following characters do not apply to *I. anodonta*: Ventral process of epandrium with truncate apex; apical portion of surstylus with 2 short, blunt, peglike bristles; epiphallus with striate surface.

Inbiomyia anodonta Buck sp. nov.

Figs. 67–73

ADULT. Wing length 1.34 mm (♂). Sclerotized portions of head medium brown, prementum brownish yellow. Orbital setulae broken off (at least 1 present), ocellar setulae present. Ocellar plate sparsely microtomentose. Inner vertical bristle broken off, probably at least half as long as orbital bristle; no postocellar setulae. Thorax including pleuron medium brown. Acrostichal rows of hairs ending posteriorly at level of postsutural pair of dorsocentrals. Anterior pair of scutellar bristles hairlike, no longer than acrostichal hairs. Legs including forecoxa pale yellowish brown. Bristles of posteroventral row of forefemur slightly stronger than anteroventral row. Male foretibia with a row of relatively short semierect, dark, ventral bristles over most of its length except extreme base. Wing almost clear. $Cs2/Cs3 = 2.2\text{--}2.4$, $Cs3/Cs4 = 2.1\text{--}2.2$. Abdominal tergites medium brown.

MALE TERMINALIA (Figs. 67–73). Ventral portion of synsternite 5+6+7 relatively wide, with more or less straight hind margin (Fig. 70). Ring-shaped sclerite present but faint. Epandrium medium brown, with strong anterodorsal apodemes (Fig. 70: ap), ventrally continuous with subanal plate, which is well sclerotized and concolorous with epandrium. Subanal plate forming an obtuse angle with posterior margin of epandrium in lateral view. Perianal field (Fig. 69) roughly elliptical, rounded below. Ventral epandrial process (Fig. 72) medium brown, shorter than surstylus, nearly straight; inner surface with more or less evenly distributed bristles; apex with a few *sensilla trichodea*. Surstylus (Figs. 68, 69) brownish, directed posteroventrally, with short stem, greatly expanded distally, with *ca.* 4 discal bristles plus a marginal fringe of bristles. Hypandrium narrowly articulated with anteroventral corner of epandrium (anterodorsal to articulation

area of ventral epandrial process), with very small emargination between posterior arms. Postgonite (Fig. 67) brown, directed ventrally (Fig. 69), stout, nearly parallel-sided from base to apex; apical margin with 4–5 stout, peglike bristles and several stout hairs; posterior surface with 1 stout, submarginal, peglike bristle. Phallus as in Fig. 73. Basiphallus brown; epiphallus long, parallel-sided, not striate, slightly curved posteriorly in lateral view. Distiphallus moderately long, ventrally with a few very small and inconspicuous spicules and no microtrichia. Ejaculatory apodeme (Fig. 71) weakly sclerotized.

FEMALE. Unknown.

TYPE MATERIAL. Holotype. ♂, UNCB, COLOMBIA: Departamento Chocó, Parque Nacional Natural Utría, Cocalito, 20 m, 6.02°N , 77.35°W , 19–27.vii.2000, canopy trap, J. Pérez, CAP-336.

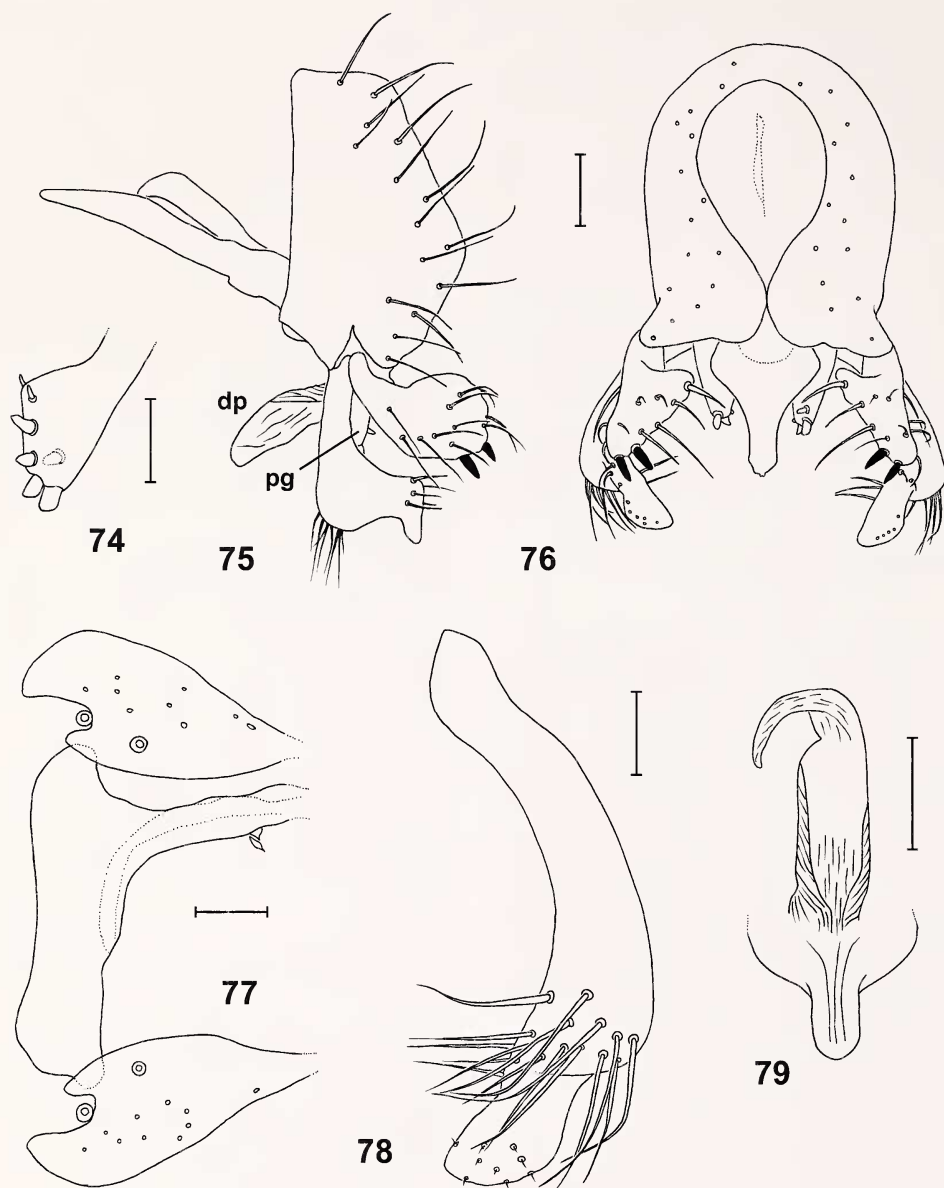
DIAGNOSIS. *Inbiomyia anodonta* is the only species in the *I. scoliostylus* group that lacks the stout, peglike bristles of the surstylus. It differs from all other species in the genus by the greatly expanded apical portion of the surstylus that bears both an apical row of bristles as well as several discal bristles. The bristles of the apical row are few in number and more widely spaced than usual. A further diagnostic character is the very stout postgonite with its very broad base.

ETYMOLOGY. The species name is a latinized adjective and refers to the lack of toothlike bristles of the surstylus (Gr. *odous*, *odontos*: tooth).

Inbiomyia scoliostylus Buck sp. nov.

(Figs. 74–79, 81; Buck, 2006: figs. 4D, E)

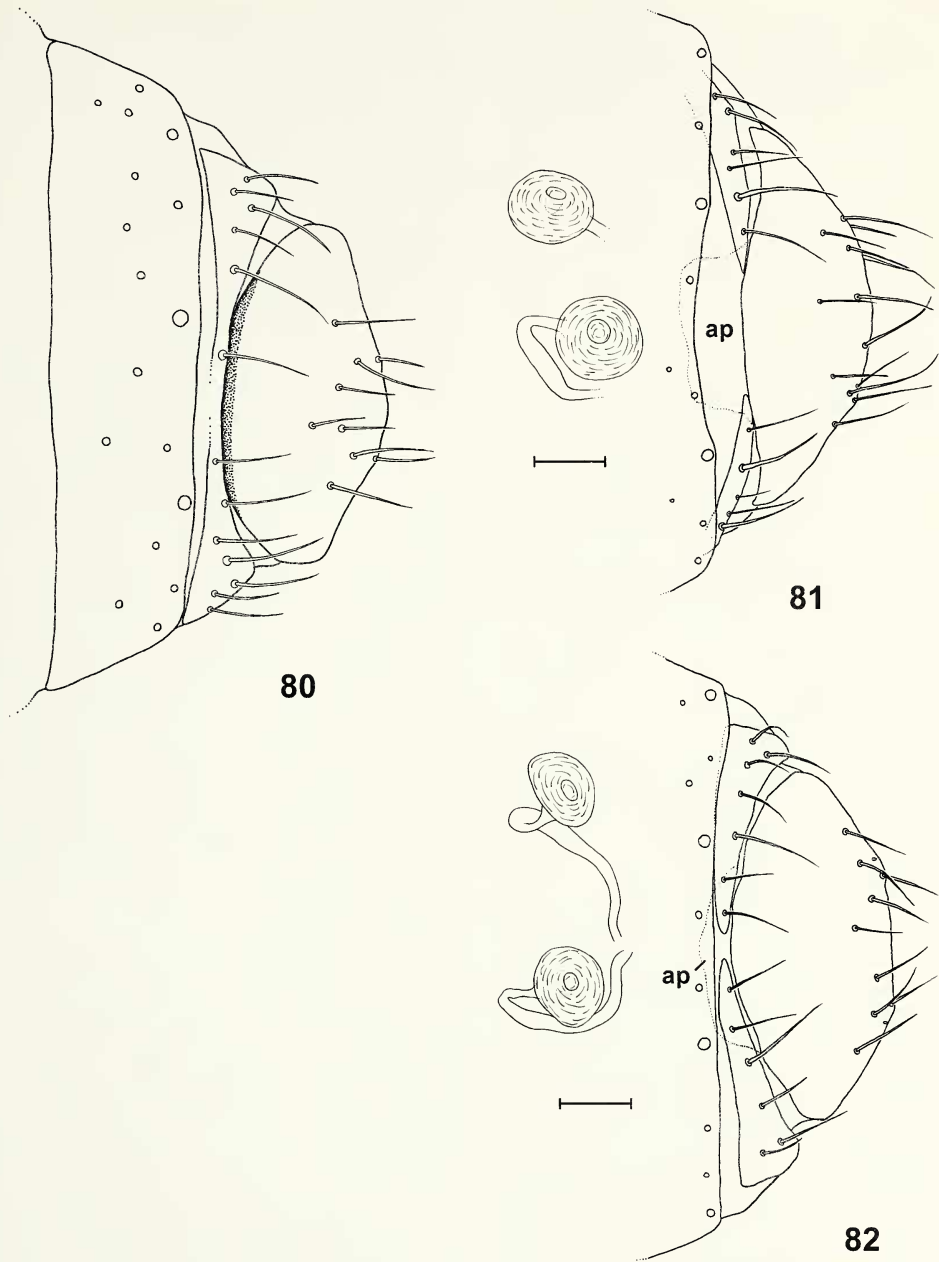
ADULT. Wing length 1.56–1.59 mm (♂), 1.74 mm (♀). Sclerotized portions of head dark brown, antenna and palpus slightly paler, prementum pale brown. Frons, besides usual long inclinate orbital bristle, with 2–3 orbital hairs and a pair of ocellar setulae. Ocellar plate sparsely microtomentose. Inner vertical bristle unusually long, almost as long as orbital bristle and longer than outer vertical; postocellar setulae present. Thorax including pleuron dark brown (paler in faded paratypes), anterior half of katepisternum paler. Acrostichal rows of hairs extending posteriorly about halfway between levels of posterior 2 pairs of dorsocentrals. Anterior pair of scutellar bristles one-third length of posterior pair, longer and than acrostichal hairs. Legs including forecoxa brownish yellow. Both antero- and posteroventral rows of bristles of forefemur stronger and darker in male than in female; bristles of posteroventral row slightly stronger than anteroventral row in female. Male foretibia with a row of relatively short semierect, dark, ventral bristles over most of its length except extreme base. Wing almost clear. $Cs2/Cs3 = 3.2\text{--}3.9$, $Cs3/Cs4 = 1.8\text{--}2.2$. Abdominal tergites dark brown.



Figures 74–79 *Inbiomyia scoliostylus* Buck sp. nov., male terminalia. 74. Left postgonite, anterior. 75. Hypopygium, left lateral. 76. Hypopygium, posterior. 77. Segments 5–8, ventral. 78. Left ventral epandrial process, anterior. 79. Phallus, ventral. Scale 0.05 mm (75–77, 79), 0.025 mm (74, 78). Abbreviations: dp—distiphallus, pg—postgonite. Drawings: A. Cormier

MALE TERMINALIA (Figs. 74–79). Ventral portion of synsternite 5+6+7 relatively broad, with more or less straight hind margin (Fig. 77). Ring-shaped sclerite present but faint. Epandrium medium brown, dorsally without pair of apodemes, ventrally continuous with subanal plate (Buck, 2006: fig. 4D), which is well sclerotized and concolorous with epandrium. Subanal plate forming an obtuse angle with posterior margin of epandrium in lateral view. Perianal field (Fig. 76) roughly elliptical, pointed below. Ventral epandrial process (Fig. 78) medium brown, longer

than surstylus, biangulate in lateral view, and widest around basal bend; basal bend ventrally with a field of long bristles; distal bend with shorter bristles dorsally, apex with scattered *sensilla trichodea*. Surstylus (Fig. 75) yellowish, directed posteriorly and with unusually short stem, expanded distally and with 2 stout, peglike bristles, otherwise only with scattered bristles on disk and hind margin but no marginal fringe. Hypandrium narrowly articulated with antero-ventral corner of epandrium (anterodorsal to articulation area of ventral epandrial process),



Figures 80–82 *Inbiomyia* spp., female terminalia and spermathecae, dorsal. 80. *I. empheres* Buck sp. nov. 81. *I. scoliostylus* Buck sp. nov. 82. *I. zeugodonta* Buck sp. nov. Scale 0.05 mm. Abbreviation: ap—anterior apodeme of tergite 8. Drawings: A. Cormier

with small and shallow emargination between posterior arms (Buck, 2006: fig. 4E). Postgonite (Fig. 74) brown, directed ventrally (Fig. 76), with short stem and dilated apex; apical margin with 4–5 stout, toothlike bristles, otherwise with very short bristles only. Basiphallus brown. Epiphallus (Fig. 79) of moderate length, longitudinally striate, relatively broad with rounded apex, slightly curved posteriorly in lateral view. Distiphallus

(Fig. 79) moderately long, ventrally neither with microtrichia nor with spicules.

FEMALE TERMINALIA (Fig. 81). Tergite 7 broadly divided medially, laterally closely joined by sternite but not fused to it. Sternite 7 evenly pigmented. Tergite 8 concolorous with preceding tergites (except medially along anterior margin, which is darker brown), with broad and long anterior apodeme (Fig. 81: ap), posterior margin

evenly convex. Spermatheca moderately sclerotized, medium brown, tire-shaped with small central invagination and laterally inserted duct.

TYPE MATERIAL. *Holotype*. ♂, INBC, COSTA RICA: Prov. San José, Tarrazú, San Carlos, Reserva Riosapraiso, Albergue Pecarí near hot springs, 405 m, 9°33'53"N, 84°7'32"W, 25.ii.2006, yellow pan traps, S.A. Marshall.

Paratypes. 1♂, 1♀, CNCI, COSTA RICA: Prov. Heredia, Braulio Carrillo National Park, 500 m, 10°10'N, 87°07'W, 10.iv.1985, H. Goulet and L. Masner.

DIAGNOSIS. This species is easily recognized by its characteristic biangulate ventral epandrial process and in the female by the combination of a medially divided tergite 7 and a large anterior apodeme to tergite 8. *Inbiomyia zeugodonta*, the only other species with medially divided tergite 7, has a smaller anterior apodeme to tergite 8 and a contrastingly colored pleuron.

ETYMOLOGY. The species name is a noun in apposition and refers to the bent ventral epandrial process (Gr. *skolios*: curved, bent).

Inbiomyia zeugodonta Buck sp. nov.

Figs. 12, 82–88

ADULT. Wing length 1.36–1.46 mm (♂), 1.51–1.59 mm (♀). Sclerotized portions of head medium to dark brown excluding medium to pale brown face and brownish yellow prementum. Antenna and palpus yellowish brown, almost concolorous with forecoxa and distinctly paler than frons. Frons beside the strong orbital bristle with 3 orbital hairs (posterior one often larger than anterior ones) and a pair of ocellar setulae. Ocellar plate sparsely microtomentose. Thorax distinctly bicolored. Lower pleuron yellow to brownish yellow, proepisternum, anepisternum, and anterior and posterior third of anepimeron medium to dark brown (concolorous with scutum); middle third of anepimeron and postnotum medium to pale brown. Acrostichal rows of hairs extending posteriorly about halfway between levels of posterior 2 pairs of dorsocentral bristles. Anterior pair of scutellar bristles one-third to two-fifths as long as posterior one, distinctly longer and more robust than acrostichal hairs. Legs including forecoxa brownish yellow. Antero- and posteroventral rows of bristles of forefemur slightly stronger and darker in male than in female; bristles of posteroventral row about as strong as those of anteroventral row in both sexes. Male foretibia with a row of relatively short semierect, dark, ventral bristles over most of its length except at extreme base. Wing membrane hardly infuscate. $Cs2/Cs3 = 2.8\text{--}3.9$, $Cs3/Cs4 = 2.0\text{--}2.2$. Abdominal tergites dark brown.

MALE TERMINALIA (Figs. 83–88). Ventral portion of synsternite 5+6+7 relatively broad, with more or less straight hind margin (Fig. 86). Ring-shaped sclerite well developed. Epandrium

dark brown, dorsally with a pair of anterior apodemes (Fig. 84: ap), ventrally continuous with subanal plate, which is well sclerotized and concolorous with epandrium. Subanal plate forming an obtuse angle with posterior margin of epandrium in lateral view. Perianal field elliptical (Fig. 85). Ventral epandrial process (Fig. 87) pale to medium brown (excluding darker base), longer than surstylus, gently curved posteriorly in lateral view and curved medially in anteroposterior view; apical half (excluding apex) with several bristles of moderate length; apex spatulate with a group of short *sensilla trichodea* on anterior surface and 2–3 bristles on posterior surface. Surstylus (Fig. 84) pale to medium brown, directed posteroventrally; stem gradually becoming wider distally and apical expansion small, with 2 stout, peglike bristles; disk and margin with scattered bristles only, marginal fringe not developed. Hypandrium narrowly articulated with anteroventral corner of epandrium (anterodorsal to articulation area of ventral epandrial process), with small emargination between posterior arms (as in Buck, 2006: fig. 4E). Postgonite (Fig. 83) brown, long, directed ventrally (Fig. 85), apex slightly dilated; apical margin with *ca.* 4 stout, peglike bristles and *ca.* 4 short, more slender, blunt-tipped bristles, otherwise with short setulae only. Basiphallus pale brownish. Epiphallus (Fig. 88) of moderate length, longitudinally striate, relatively broad with rounded apex, slightly curved posteriorly in lateral view. Distiphallus (Fig. 88) moderately long, ventral surface with sparse, short, inconspicuous microtrichia.

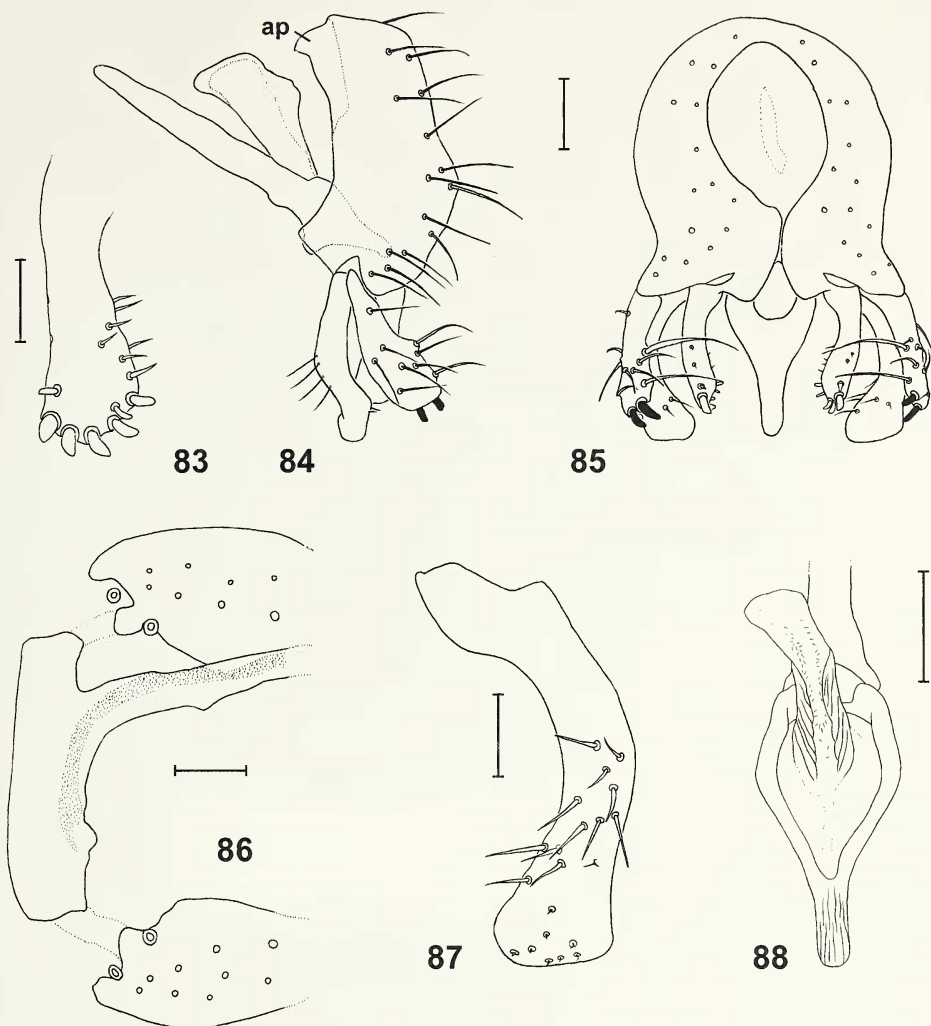
FEMALE TERMINALIA (Fig. 82). Tergite 7 narrowly divided medially, laterally free from sternite. Sternite 7 evenly pigmented. Tergite 8 paler than dark brown preceding tergites (except medially along anterior margin), with broad but short anterior apodeme, posterior margin truncate medially. Spermatheca moderately sclerotized, medium brown, tire-shaped with small central invagination and laterally inserted duct.

EGG (Fig. 12). Almost identical to *I. acmophallus* but slightly wider (length 0.39 mm, width 0.23 mm) and micropylar pole more projecting.

TYPE MATERIAL. *Holotype*. ♂, UNCB, COLOMBIA: Comisaría Amazonas, Amacayacu National Park, Sector Matamata, 150 m, 3–9.iv.2000, Malaise, A. Felix.

Paratypes. 11♂, 8♀. COLOMBIA: Comisaría Amazonas, Amacayacu National Park, Sector Matamata, 150 m, 27.iii–3.iv.2000, Malaise, A. Parente (2♂, 1♀, LACM; 2♂, DEBU); same data except 3–9.iv.2000, A. Felix (4♂, 4♀, UNCB; 1♂, 1♀, LACM; 2♀, DEBU); same data except 11–24.iv.2000, A. Felix (2♂, UNCB).

OTHER MATERIAL EXAMINED. COLOMBIA: Departamento Nariño, Orito, Territorio Kozan, 0°30'N, 77°13'W, 1000 m, 25.ix.1998, Malaise, E. González (1♀, UNCB). FRENCH GUIANA: Regina, Kaw Mt., Patawa, 4.54°N,



Figures 83–88 *Inbiomyia zeugodonta* Buck sp. nov., male terminalia. 83. Right postgonite, inner surface. 84. Hypopygium, left lateral. 85. Hypopygium, posterior. 86. Segments 5–8, ventral. 87. Left ventral epandrial process, anterior. 88. Phallus and base of phallapodeme, ventral. Scale 0.05 mm (84–86, 88), 0.025 mm (83, 87). Abbreviation: ap—anterior apodeme of epandrium. Drawings: A. Cormier

52.15°W, 400 m, iv.2005, Malaise, J.A. Cerda (2♀, LACM); same as previous but iii.2005 (1♀, LACM). Note: Females that are not associated with males are tentatively identified as *I. zeugodonta*.

DIAGNOSIS. *Inbiomyia zeugodonta* resembles *I. scoliostylus* in possessing a surstylus with 2 stout, peglike bristles. It differs from that species by the curved (not angulate) ventral epandrial process, the contrastingly colored pleuron, and, in the female, the shorter anterior apodeme of tergite 8.

ETYMOLOGY. The species name refers to the paired, stout, toothlike bristles of the surstylus (Gr. *zeugos*: team, pair; Gr. *odontos*: tooth). The species name represents a latinized adjective.

Inbiomyia sp. 3

MATERIAL EXAMINED. ECUADOR: Prov. Pichincha, Río Palenque, 0°35'S 79°22'W, 150 m, 22–26.ii.1976, G. and M. Wood (1♀, CNCI).

REMARKS. Large, wing length 1.74 mm. This species shares the well-developed chaetotaxy with *I. scoliostylus* and *I. zeugodonta*: Inner vertical bristle longer than outer vertical and almost as long as orbital bristle, ocellar and postocellar setulae present; postpronotal bristle well developed, 3–4 dorsocentral setulae between postsutural and pre-scutellar dorsocentral bristles; anterior pair of scutellar bristles 0.4× as long as posterior pair. Spermatheca tire-shaped. *Inbiomyia* sp. 3 differs from the species of the *I. scoliostylus* group by the fused tergite and sternite of segment 7.

ACKNOWLEDGMENTS

We would like to thank B.V. Brown (LACM), M. Zumbado (INBC), J.M. Cumming and J. Skevington (both CNCI), D. Grimaldi (AMNH), C. Sarmiento (UNCB), and J. Sarmiento (CBFC) for the opportunity to study material under their care. We also thank S.D. Gaimari, A.L. Norrbom, N.E. Woodley, and an anonymous reviewer for thorough reviews of this paper. The Royal Entomological Society of London is thanked for permission to reproduce Figs. 3 and 11 from Buck (2006). This work was funded through grants by the Natural Sciences and Engineering Research Council (NSERC) to S.A. Marshall.

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Received 3 November 2005; accepted 5 June 2006.



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